Final Design Report

BESSRC CAT 12-ID

April 1996

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Introduction

The Preliminary Design Report (PDR) for the BESSRC CAT sectors at the Advanced Photon Source (APS) provided the information about the scientific programs at all the BESSRC beamlines and detailed drawings of the beamline layouts. This document provides final drawings and further explains the details of the 12-ID beamline. Where we feel it is necessary for a through understanding of the beamline, information from the PDR or references to other BESSRC beamlines will be included.

The future plans for this beamline call for the addition of a focusing mirror to be used for focusing of the white beam and to allow either monochromatic or pink light operation of the experimental stations along the beamline. The FDR for the 12-ID beamline includes the requirements for the Personnel Safety System (PSS) and Equipment Protection System (EPS) for both monochromatic and Pink Light operation of the 12-ID Experimental Stations.

Scientific Programs

The 12-ID beamline is a multipurpose beamline for the study of time dependent phenomena, diffraction and scattering experiments, small angle scattering, atomic physics and surface scattering and diffraction. Each of these activities is in general confined to one of the experimental stations on the 12-ID beamline. Details of the scientific program in these areas are found in the 12-ID section of the PDR and are also contained in the Basic Energy Sciences Synchrotron Radiation Center (BESSRC) Collaborative Access Team (CAT) Proposal. Much of the BESSRC CAT's equipment will be modular to allow experiments to be done on any of the three BESSRC beamlines.

Beamline Layout

Beamline Description

The 12-ID beamline is shown in Figure 1. The beamline has four enclosures; 12-ID-A, a white-beam first optics enclosure (FOE) ; 12-ID-B, a white light shielded experimental station for scattering, diffraction and small angle diffraction experiments; the 12-ID-C monochromatic enclosure, housing atomic physics experiments; and the 12-ID-D enclosure which will contain instrumentation for

surface scattering and Chemical Vapor Deposition (CVD) experiments. Shielding for white radiation in the 12-ID-B enclosure has been added for future additions to the 12-ID beamline. Table 1 lists the beamline components and distances from the center of the insertion device. A detailed description of the individual components can be found in the appropriate APS documents or in the BESSRC CAT Preliminary Design Reoprt (PDR).

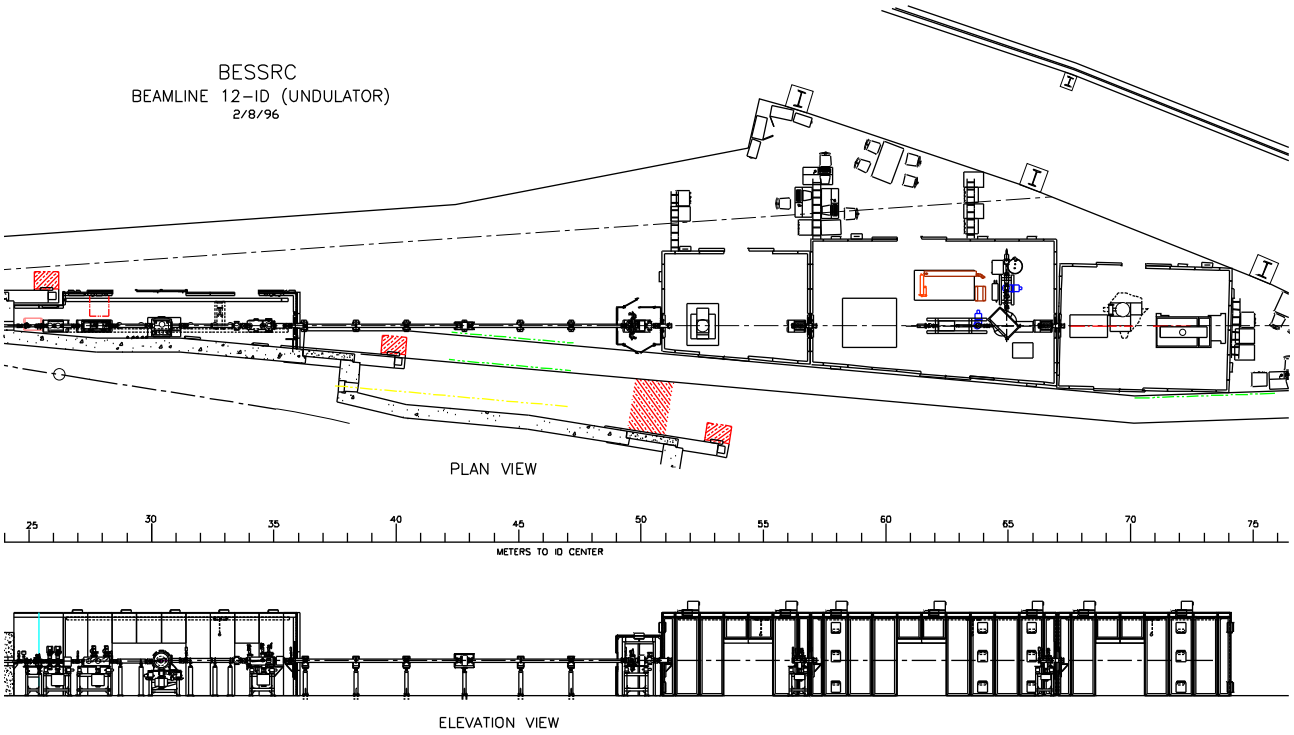

Figure 1. Plan and elevation views of the 12-ID beamline.

Table 1 12-ID Beamline Components and Location

Component	Part #	Location(m)
Center of Straight Section		*0.0*
Undulator A		*1.25*
Wall Penetration		*24.39*
Be Window		*24.81*
Table for Differential Pump		
Differential Pump/Contamination Barrier		*24.81*
Table for F2-30 Filter	T5-31	
White Light Filter	F2-30	25.72
Collimator	K1-A	26.37
Table for L5 Slits	T5-62	
White Light Slits	L5-20	27.02
Monochromator	BESSRC Std. Mono	30.0
Table for P4 Shutter	T5-33	
White Light Shutter and Back Stop	P4-20	33.88
Collimator	K1-B	35.04
End of 12-ID-A (FOE)		36.06
12-ID Optics Enclosure		49.02 - 50.85
Table for L2 Slit	T5-35	
Monochromatic Slit Assembly	L2-20	49.40
Beam Profile Monitor	B5-20	50.19
12-ID-B Experimental Station		50.85 - 56.92
Be Window	W4-20	51.00
Table for P8 Shutter	T5-65	
Photon Shutter and Backstop	P8-20	56.24
12-ID-C Experimental Station		56.92 66.98
Be Window	W4-20	57.02
Table for P8 Shutter	T5-65	
Photon Shutter and Backstop	P8-20	66.30
12-ID-D Experimental Station		67.04 - 74.08
Be Window	W4-20	67.13

The FOE (12-ID-A) contains all the white light components, white light Be window (to eventually be replaced with a differential pump for windowless operation), Filters, Slits, the BESSRC Standard Monochromator, and the Shutter for this beamline. At the present time, the intended use of the P4-20 shutter is to allow the addition of a focusing mirror to the beamline to allow the usage of the 12-ID experimental stations for pink beam operation. The future usage of this component will be to switch between mono-pink operation and white beam operation of the beamline. However, usage of this component in the initial phases of operation will be confined to a monochromatic shutter / white beam stop.

A small monochromatic (pink) shielded enclosure at approximately 50 m is to be used for the beamline monochromatic slits and a beam position monitor. A fast shutter system to be used for timing experiments will be located either in this enclosure or at the front (upstream end) of the 12-ID-B enclosure. Access to this enclosure will be infrequent once commissioning is finished, therefore, the use of Administrative Control procedures is planned.

The 12-ID-B experimental station is a white light shielded experimental station. The initial experimental equipment in the 12-ID experimental station includes a Huber Psi 8-circle goniometer. The table for this instrument is being designed to allow the sharing of equipment among the BESSRC experimental stations.

Atomic physics experiments are planned for the 12-ID-C monochromatic enclosure. Details of the instrumentation for this enclosure are given in the BESSRC CAT PDR (Section IV.4.2).

The end station 12-ID-D is a monochromatic enclosure that will be used jointly for surface scattering, X-ray standing wave and in-situ CVD experiments. The instrumentation for this station includes a surface standing wave apparatus which will be moved from the NSLS X15A beamline and CVD equipment which has been moved from SSRL. The design and construction of a surface scattering chamber for this station and of post monochromator optics are underway.

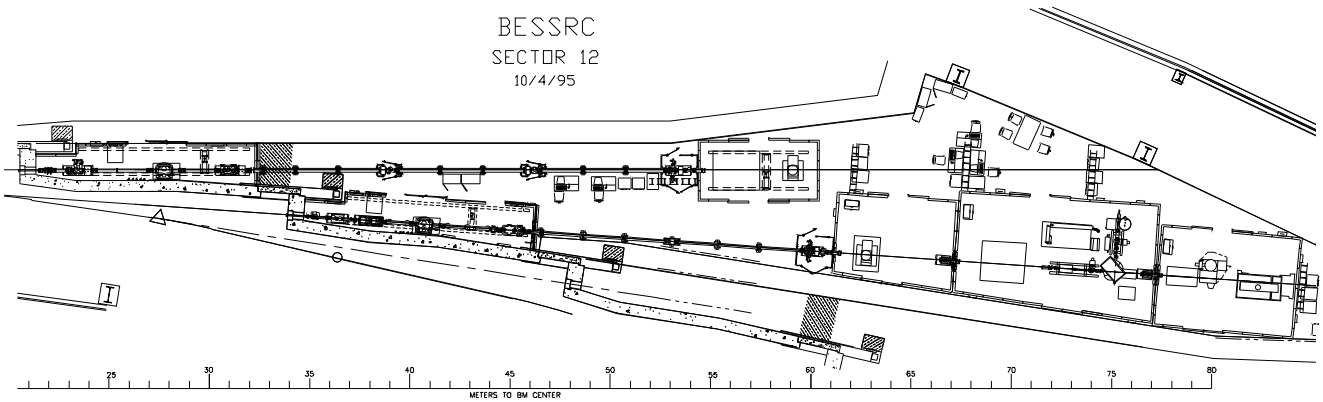

Figure 2 Top view of bending magnet and insertion device beamlines on sector 12.

Beamline Drawings

Detailed drawings of the 12-ID beamline are included. Appendix A contains the complete drawing list that corresponds to each figure in the FDR. Figure 2 is a reduced version of a drawing showing the sector 12 layout to show personnel access to the ID beamline hutches and any possible interferences between the two beamlines. Figure 3 shows the 12-ID-A enclosure (FOE) with major components labeled. The complete set of drawings which correspond to this figure includes the 12-ID-A hutch drawing and the top and side views of the assembled beamline. The transport section between the 12-ID-A enclosure and the 12-ID-B enclosure is shown in Figure 4. The drawing package for Figure 5, which shows the 12-ID-B enclosure, includes hutch drawings and drawings for the small enclosure which shields the L4-20 monochromatic slit and beam position monitor. Figure 6

gives detailed drawings of the 12-ID-C enclosure while Figure 7 contains drawings for the 12-ID-D station.

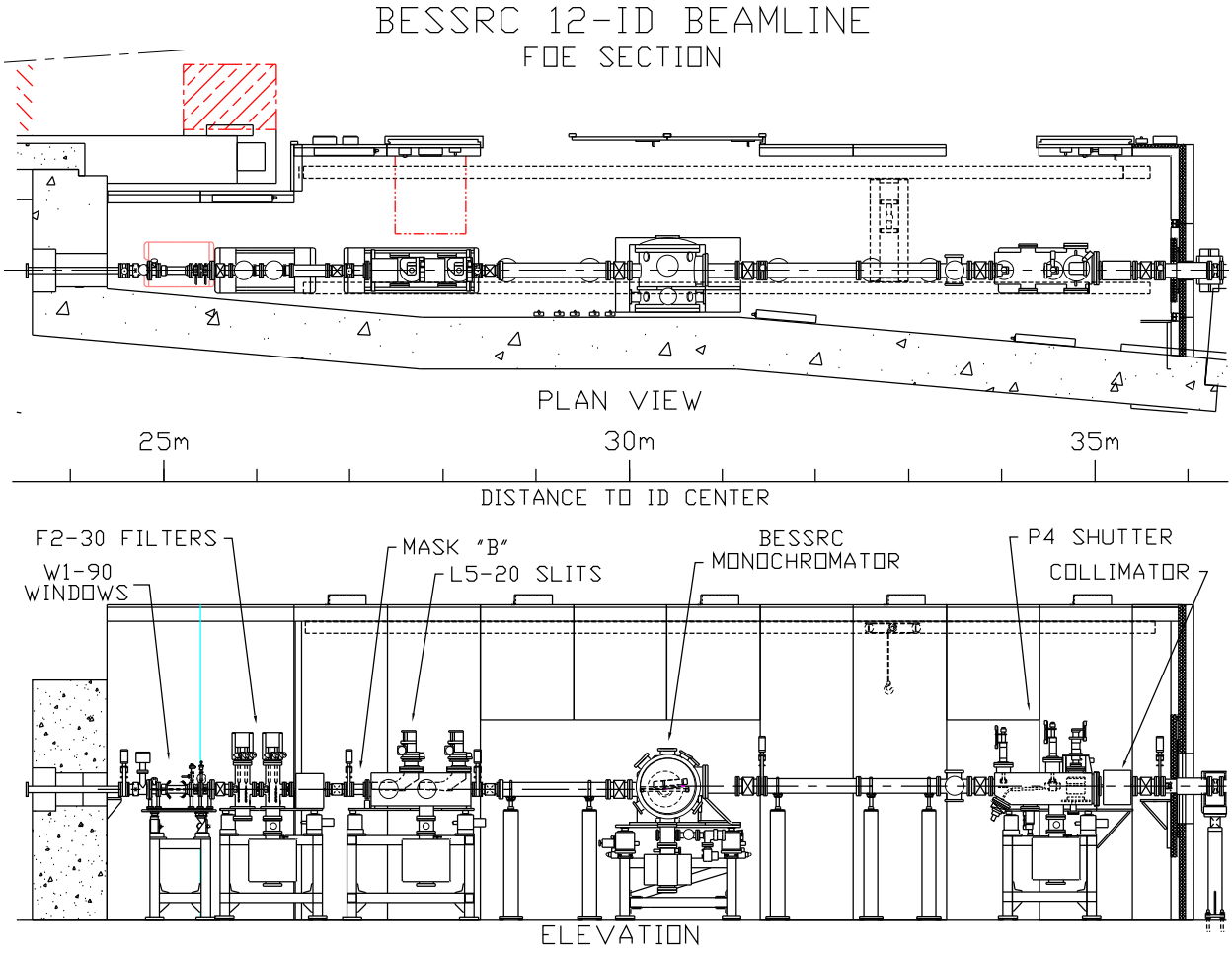

Figure 3. Top and side views of 12-ID-A (FOE). Major components are noted in the side view.

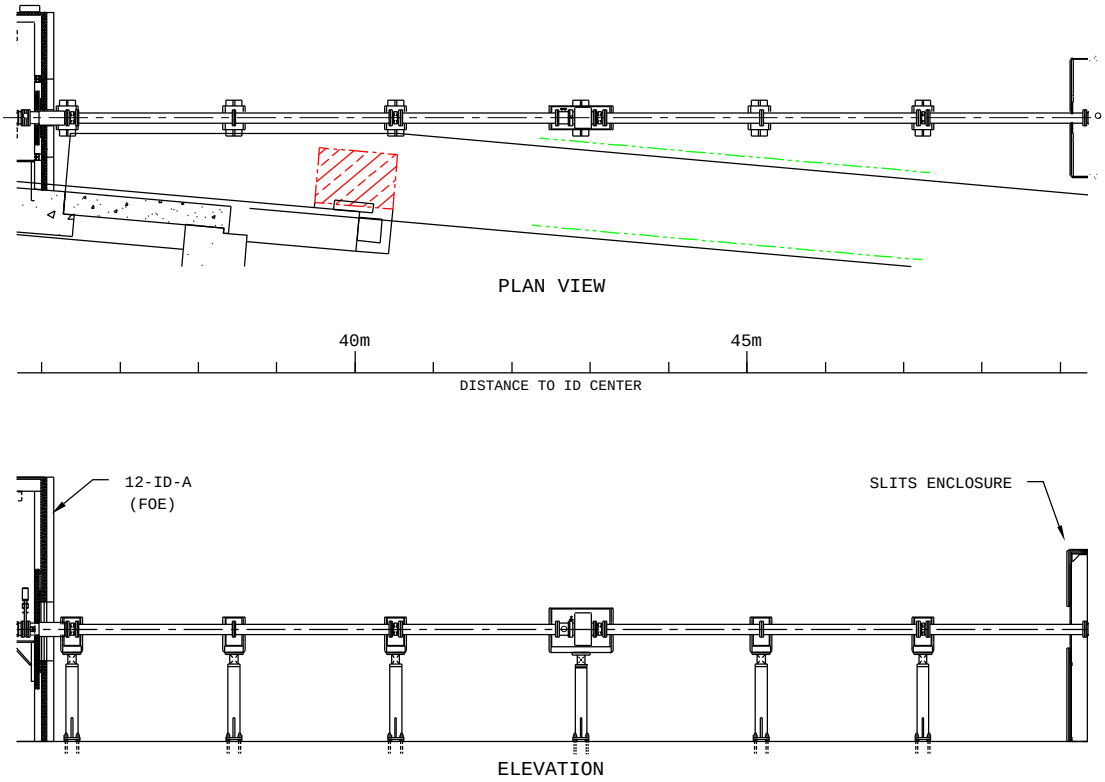

Figure 4 Transport section of the 12-ID beamline.

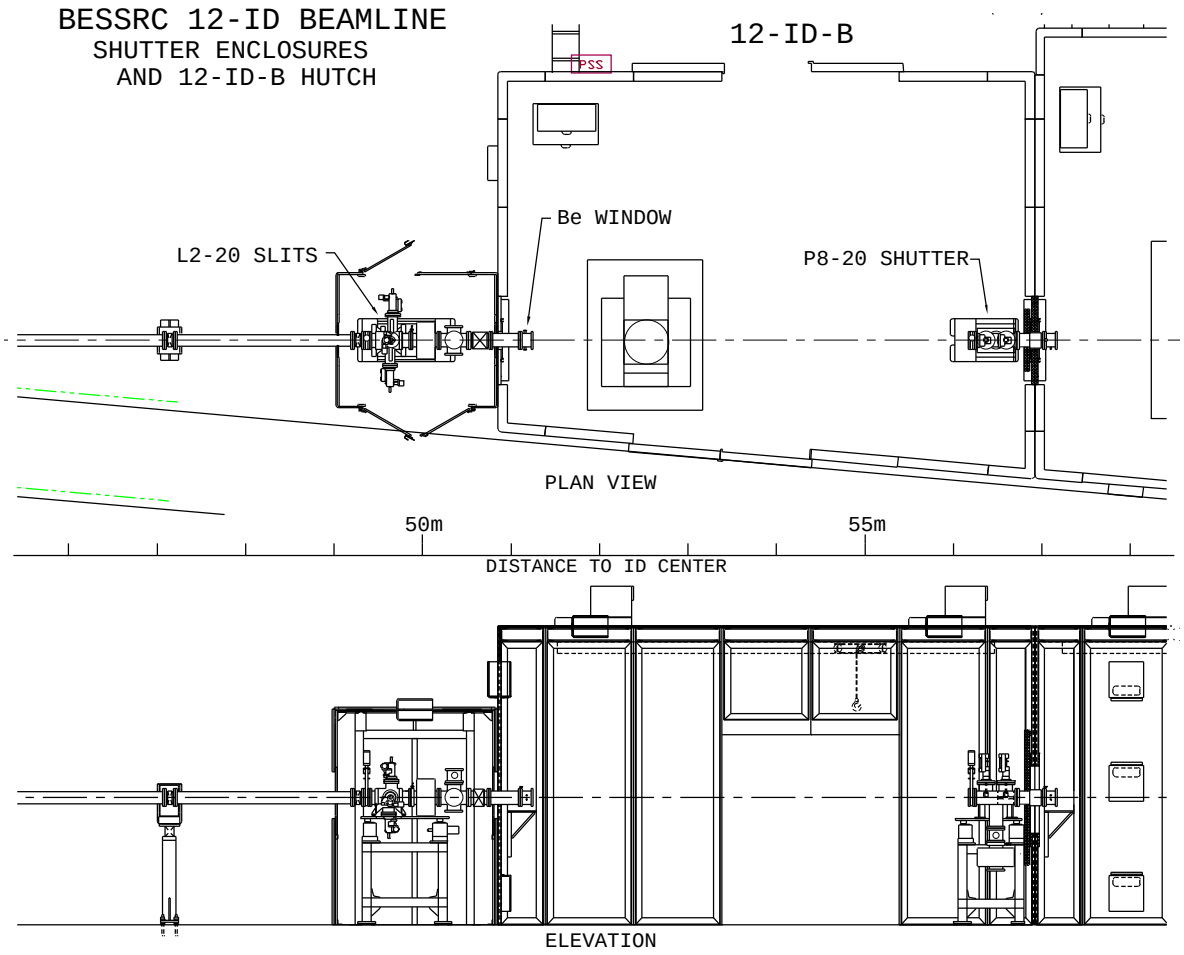

Figure 5 Plan and elevation views of the 12-ID-B experimental hutch.

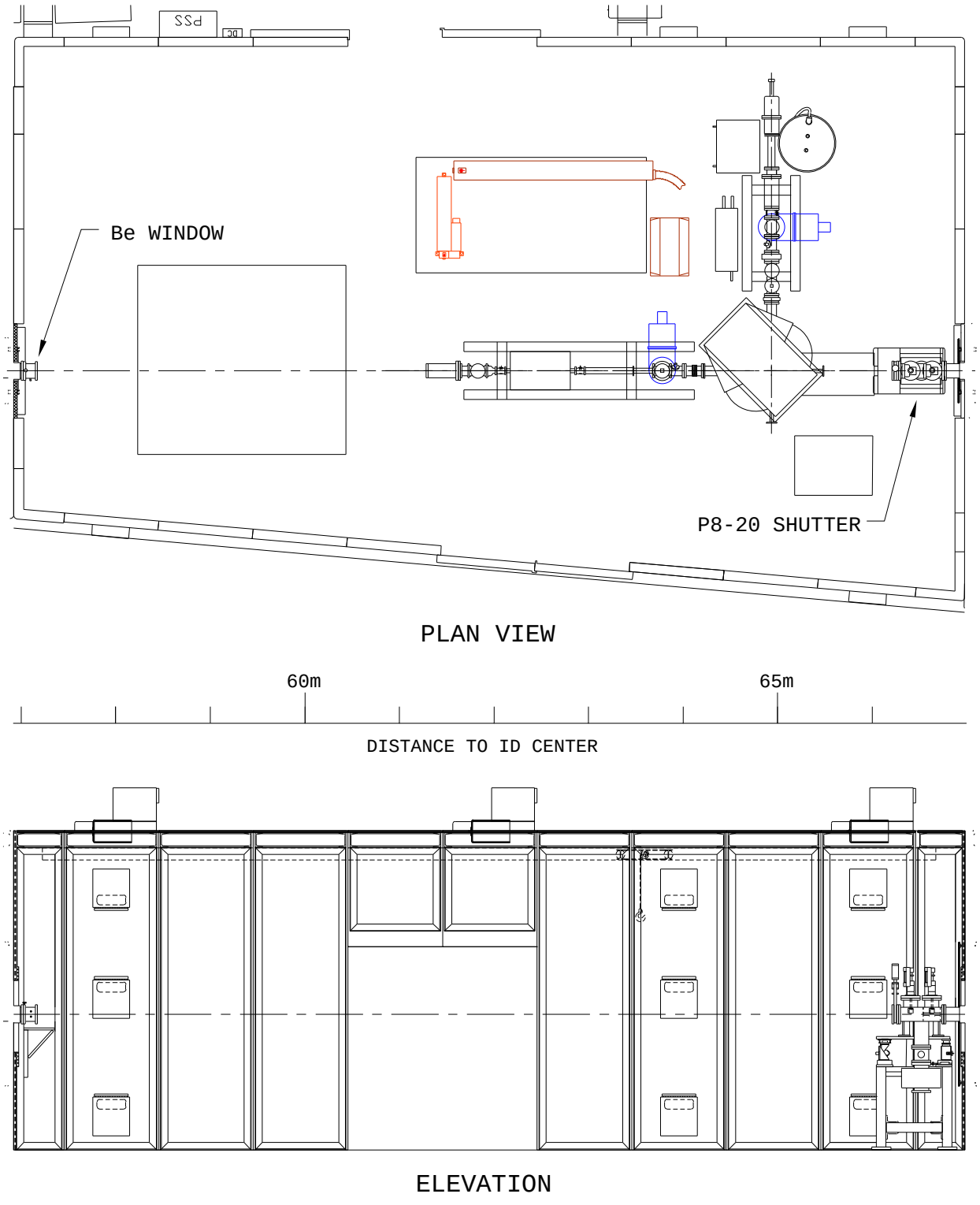

Figure 6 Plan and elevation views of the 12-ID-C experimental hutch.

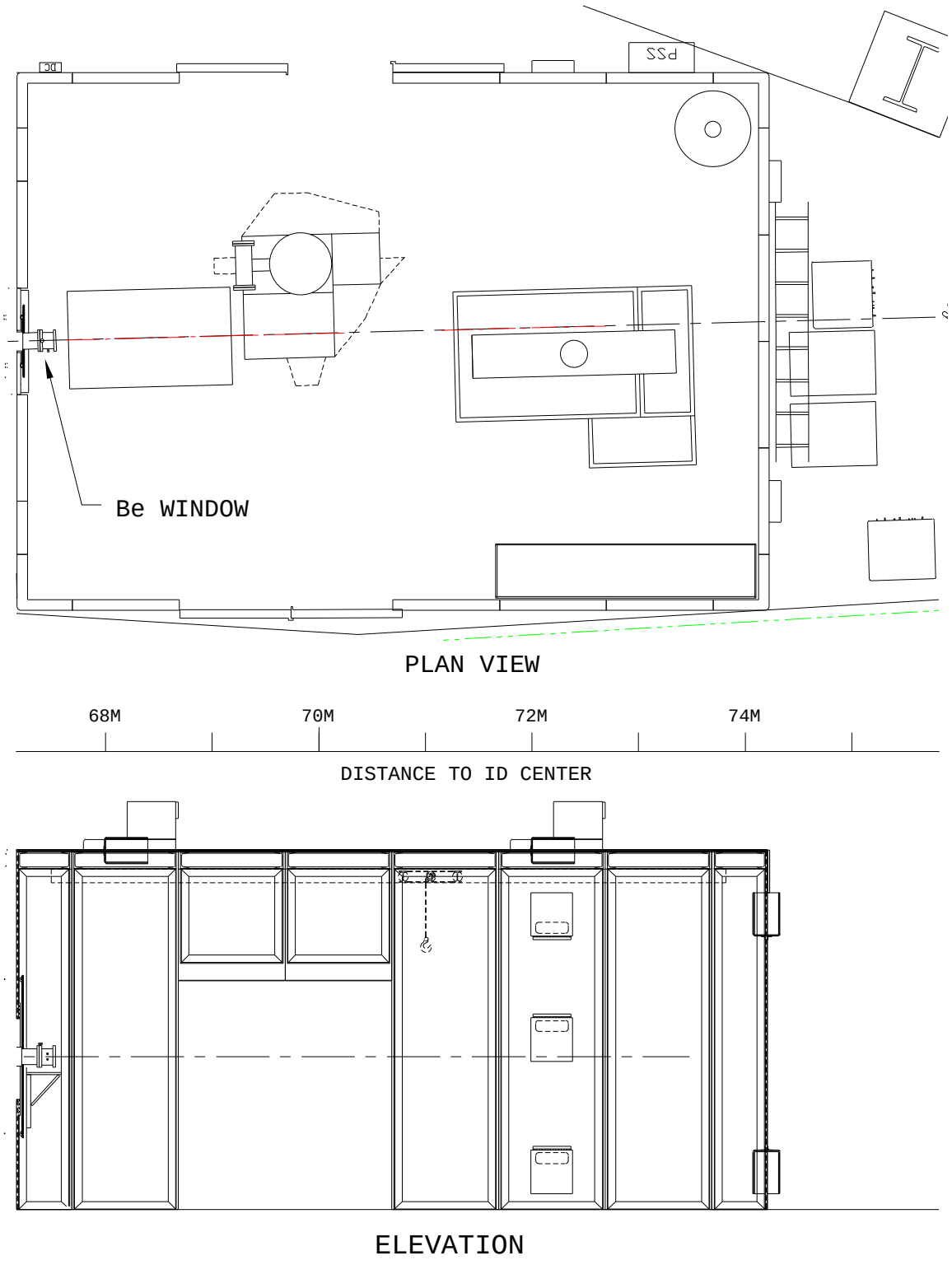

Figure 7 Plan and elevation views of the 12-ID-D experimental hutch.

Changes from PDR

The major changes to the 12-ID beamline since the PDR are: the addition of white-beam shielding to the 12-ID-B enclosure; a 1 meter enlargement of the 12-ID-D enclosure to accommodate both surface scattering and CVD experimental apparatus; the elimination of one of the small enclosures at the front of the 12-ID-B experimental station; and the addition of a second bremsstrahlung collimator at the rear of the 12-ID-A enclosure. In addition, minor changes have been made to the beam transport between the FOE and the experimental stations primarily to utilize APS components which have been designed since the PDR. Other minor changes also include: small changes in the position of the enclosures along the transport section to allow "standard length" transport pipes to be used; and small shifts of the standard components in the FOE. Appendix B gives a listing of all the components and their placements along the beamline.

Survey and Alignment Plan

Following the designations used by the SRI CAT, critical components aperture the white beam or act as beamstops while non-critical components are white beam components which are not beam defining or are monochromatic components. Components such as monochromators, mirrors and equipment inside the experimental hutches are considered experimental components. The beamline components which are considered critical with respect to survey and alignment are the F2-30 Filter, L5-20 Slit assemblies, the P4-20 Shutter / Stop, and the P8 shutters which must be carefully aligned to stop the white beam. The non-critical components in the 12-ID beamline include the L2-20 Monochromatic Slit assembly, beam position monitor and W4-20 Be windows. The BESSRC monochromator and the experimental instrumentation are experimental components. Table 2 contains a complete listing of the components along with the required level of survey and alignment which will be required.

Alignment Procedure for Critical Components

The alignment of Critical Beamline Components will be done in conjunction with the APS/XFD engineering group and APS survey group using alignment procedures which they have established.

Alignment Procedure for Non-Critical Components

The alignment of Non-Critical Beamline Components will be done by BESSRC CAT personnel. For the L2-20 Monochromatic Slit assembly, and P8 shutters in the experimental stations

assistance from the APS/XFD engineering group will be necessary. The procedure to be used for these components follows that given in the SRI CAT FDR. The assistance of the APS/XFD engineering group will be required to determine positions of the centerline for these components relative to fiducials attached to the component. BESSRC CAT personnel will then use normal measurements (level, plumb bob and rules) to locate these components on the beam centerline.

Alignment Procedure for Experimental Components

The coarse alignment of experimental components including the monochromator and equipment in the experimental hutch will be done using the equipment described above. Fine alignment of these components will be done using x-rays during beamline commissioning.

Table 2 Survey and Alignment of Components and survey level

BESSRC Part#	Description	Critical	Non-Critical	Exper.	Alignment done by
12ID3	GATE VALVE	X			APS
12ID4	WELDED BELLOWS		X		APS
12ID7	*DIFFERENTIAL PUMPS*	X			APS
12ID8-9	FIRST WINDOWS	X			APS
12ID10	WELDED BELLOWS		X		APS
12ID13	FILTERS	X			APS
12ID14	WELDED BELLOWS		X		Connected to adjacent components
12ID15	FILTERS	X			APS
12ID18	FORMED BELLOWS		X		Connected to adjacent components
12ID19	COLLIMATOR		X		Connected to adjacent components
12ID20	FORMED BELLOWS		X		BESSRC
12ID21	GATE VALVE		X		BESSRC
12ID23	FIXED MASK	X			APS
12ID24	ADAPTER FLANGE 6"-8"		X		
12ID25	SLIT ASSEMBLY	X			APS
12ID28	GATE VALVE		X		BESSRC
12ID29	FORMED BELLOWS		X		BESSRC
12ID30	ADAPTER FLAGE 6" - 8"		X		BESSRC
12ID31	TUBE		X		BESSRC
12ID34	FORMED BELLOWS		X		BESSRC
12ID36	MONOCHROMATOR			X	
12ID41	ADAPTER		X		BESSRC
12ID42	FORMED BELLOWS		X		BESSRC
12ID43	GATE VALVE		X		BESSRC
12ID44	TUBE		X		BESSRC
12ID47	TUBE		X		BESSRC
12ID49	6-WAY CROSS		X		BESSRC
12ID50	FORMED BELLOWS		X		BESSRC
12ID52	P4-20 SHUTTER	X			APS
12ID55	ADAPTER FLANGE14"- 8"		X		BESSRC
12ID57	COLLIMATOR		X		BESSRC
12ID58	FORMED BELLOWS		X		BESSRC
12ID59	GATE VALVE		X		BESSRC
12ID61	TRANSITION PIPE		X		BESSRC

Table 2 Survey and Alignment of Components and Survey Level (continued)

BESSRC Part#	Description	Critical	Non-Critical	Exper.	Alignment done by
12ID62	BELLOWS		X		BESSRC
12ID64	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID66	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID67	BELLOWS		X		BESSRC
12ID69	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID70	PUMP-OUT SPOOL		X		BESSRC
12ID71	ION PUMP		X		BESSRC
12ID73	BELLOWS		X		BESSRC
12ID74	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID76	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID77	BELLOWS		X		BESSRC
12ID79	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID82	BELLOWS		X		BESSRC
12ID83	GATE VALVE		X		BESSRC
12ID84	SLITS, L2-20		X		BESSRC
12ID85	ION PUMP		X		BESSRC
12ID86	B. P. M.		X		BESSRC
12ID88	FORMED BELLOWS		X		BESSRC
12ID89	SHIELDED TRANSPORT PIPE		X		BESSRC
12ID91	Be WINDOW		X		BESSRC
12ID94	GATE VALVE		X		BESSRC
12ID95	PHOTON SHUTTER P8-20	X			BESSRC/APS
12ID98	SHIELDED TRANSITION PIPE		X		BESSRC
12ID100	Be WINDOW		X		BESSRC
12ID103	GATE VALVE		X		BESSRC
12ID104	PHOTON SHUTTER P8-20	X			BESSRC/APS
12ID107	SHIELDED TRANSITION PIPE		X		BESSRC
12ID109	Be WINDOW		X		BESSRC

Utilities

Figure 8 shows the utilities distribution plan from the mechanical mezzanine along the 12-ID beamline to the 12-ID transport section and finally on to the 12-ID experimental hutch and FOE. The cable trays for the utilities are suspended over the 12-ID beamline from pillars just outside the beamline components. This design minimizes the floor space occupied by the beamline. The schedule for utilities installation is given in Appendix C.

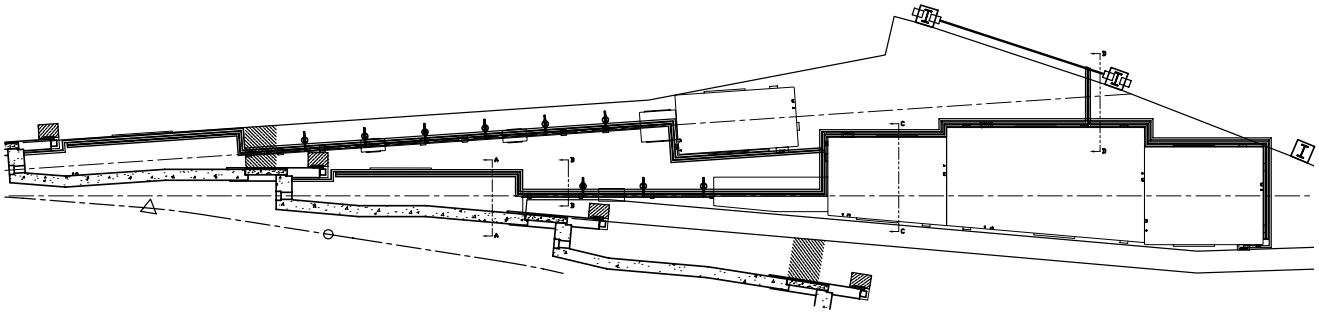

Figure 8. Utility layout for Sector 12. Top view of the cable tray layout for both the Bending Magnet and Insertion Device beamlines is shown.

Chilled Water

Chilled water will be distributed in 2" O.D. copper tubing at the supply pressure. Inside the experimental stations the chilled water will be distributed in 1" O.D. copper tubing. Taps for chilled water will be available in the 12-ID-B 12-ID-C 12-ID-D enclosures and in the FOE near a DI (deionized) water-water chiller which will provide cooling for FOE components.

Deionized Water

For the 12-ID beamline all FOE components will require DI water. The F2-30 filter requires 1 gpm @ 35 PSI, while the L5-20 Slit requires 2 gpm @ 45 PSI and the P4-20 shutter/stop requires 5 gpm @ 80 PSI. These flow and pressure requirements will be met for the 12-ID beamline by a recirculating water to water chiller which has an ion-exchange cartridge and filter in the cooling loop to be located inside the FOE.

Electrical

The power requirements of the experimental stations on the 12-ID beamline are noted on the hutch drawings given in Figures 3 and 5-7. Of the 30 kVA of utility power and 30 kVA of clean power available for the 12-ID beamline, the FOE (12-ID-A) will receive a maximum of 15 kVA of utility power and 10 kVA of clean power. The remainder of the power allocated to 12-ID will be used for the 12-ID-B enclosure and for outlets distributed along the beamline. It should be noted that the total power requested for all experimental stations and locations along is considerably in excess of the 30 kVA of utility power and 30 kVA of clean power provided. Therefore, additional transformers will be required to meet the power needs of the Sector 12-ID beamline. The locations of the outlets distributed along the beamline are noted on the utilities drawings (Fig. 8).

Compressed Air

Compressed Air will be distributed along the beamline with 1/2" O.D. soldered Cu tubing. Hookups will be available at the ends of the experimental stations and at drops along the length of the transport section (see Fig. 8).

Ray tracing

Ray tracings for the 12-ID beamline are given in Figures 9 A,B,C and D. Only minor changes have been made to the beamline design since the BESSRC PDR. Figures 9C and 9D however show the beamline ray tracings with the addition of a white light mirror before the monochromator which was not discussed in the PDR . These drawings show that the beamline configuration for monochromatic operation will also block bremsstrahlung radiation for pink beam operation.

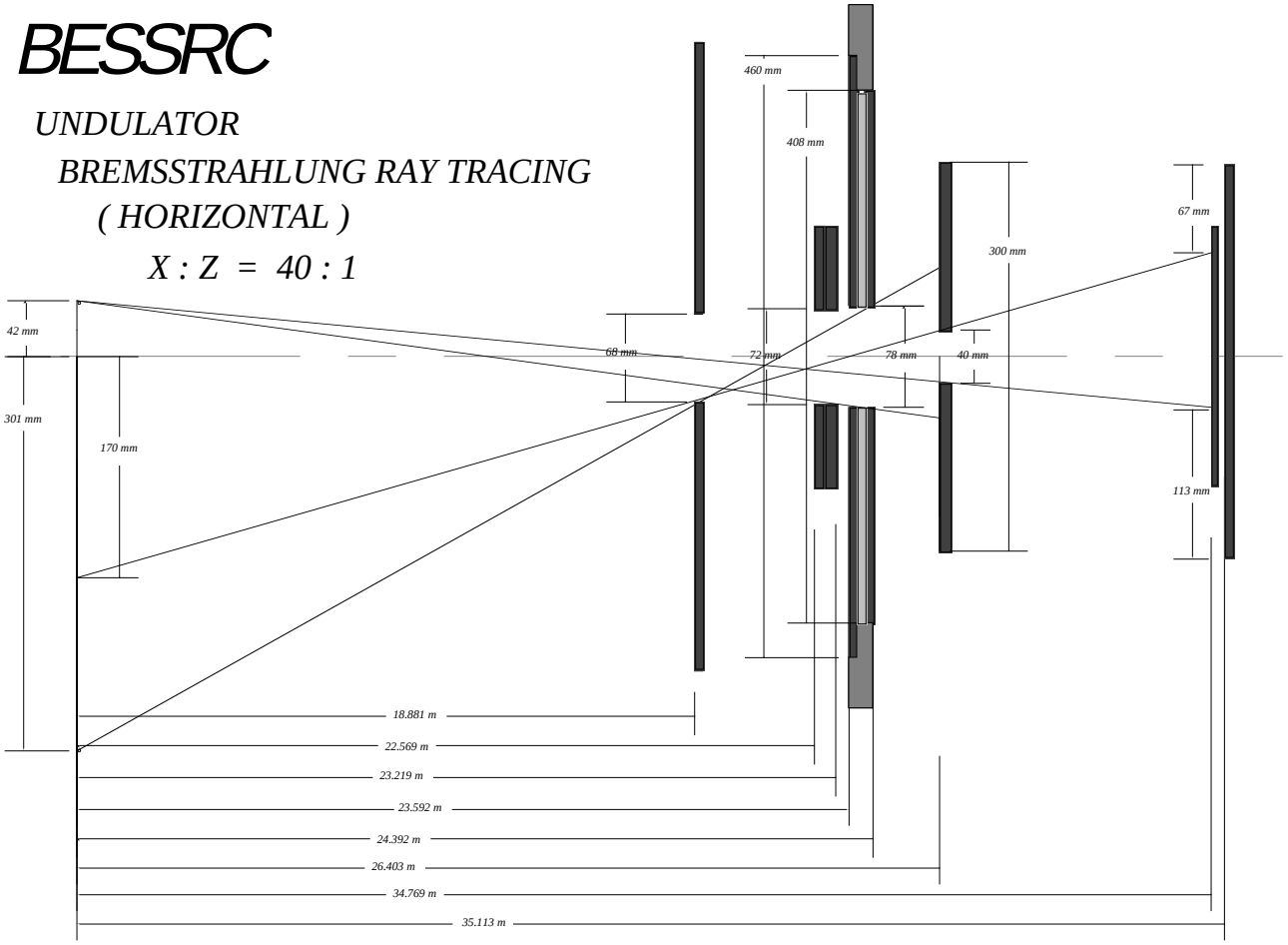

Figure 9A Horizontal Ray tracing for the 12-ID beamline reflecting the final component positions along the beamline.

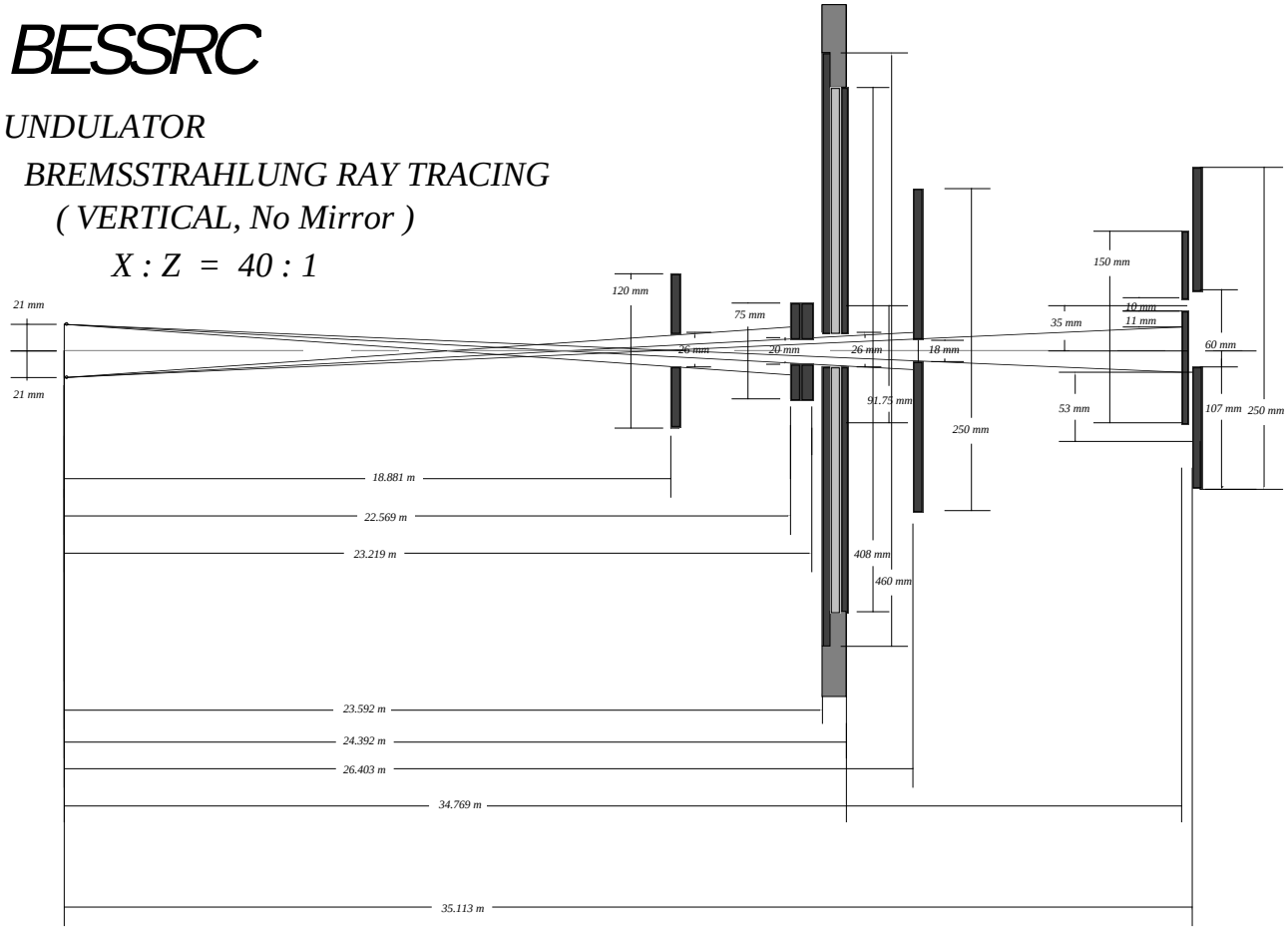

Figure 9B Vertical Ray tracing for the 12-ID beamline.

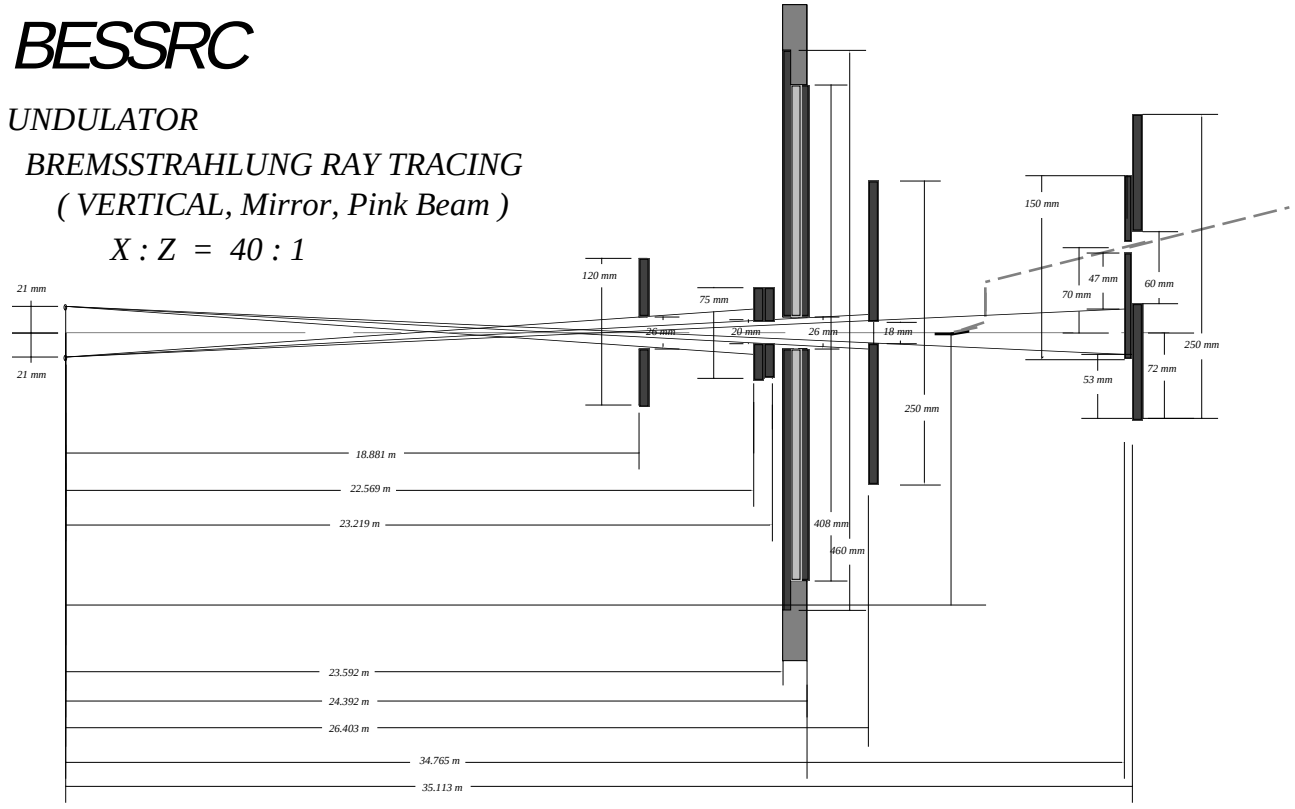

Figure 9C Vertical Ray tracing with only a mirror for pink beam operation.

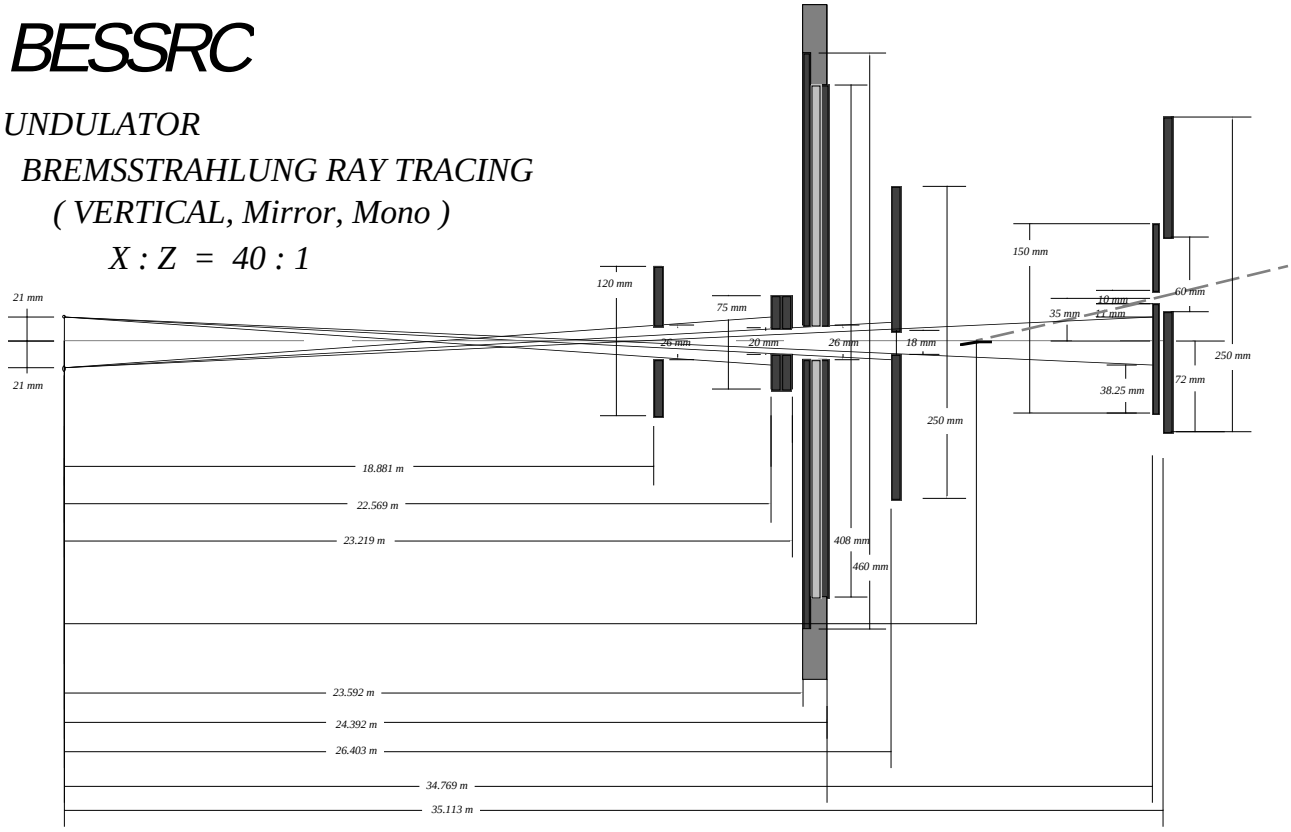

Figure 9D Vertical Ray tracing with both a mirror and monochromator in the beamline.

Beamline Design

Component Assemblies

Appendix B gives a complete listing of all the components on the 12-ID beamline. Since all components except the BESSRC Monochromator are APS standard components, assembly drawings are not included for these components. Drawings of the monochromator chamber and monochromator support table were given in the FDR for the 12-BM beamline.

Table 3 Vacuum, Type of Radiation, PSS, and EPS Status for 12-ID Components.

Part#	Description	Vac. Status	PSS* Status	EPS Status **				Comments
				Water flow	Posit-ion	Vac.	Temp	
12ID8-9	Front End Be Window	UHV *		Y		Y	Y	APS
12ID10	F.E. Welded Bellows	UHV						start of BESSRC components
12ID13	F2-30 Filter Assembly	UHV		Y	Y	Y	Y	STD Component, EPS Control
12ID18	Welded Bellows	UHV						
12ID19	Collimator, K1A	UHV	A					Part of Bremm. Shielding
12ID20	Formed Bellows	UHV						
12ID21	Gate Valve	UHV			Y			Position controlled by EPS
12ID25	L5-20 Slits	UHV		Y	Y	Y	Y	STD Component
12ID28	Gate Valve	UHV			Y			Position controlled by EPS
12ID29	Formed Bellows	UHV						
12ID30	Adapter Flange 6"-8"	UHV						
12ID31	Transport Pipe	UHV						
12ID34	Formed Bellows	UHV						
12ID36	BESSRC Mono	UHV		Y	N	Y	Y	
12ID41	Adapter Pipe	UHV						
12ID42	Formed Bellows	UHV						
12ID43	Gate Valve	UHV			Y			Position controlled by EPS
12ID44	Transport Pipe	UHV						
12ID47	Transport Pipe	UHV						
12ID49	6-Way Cross	UHV						FOR BPM
12ID50	Formed Bellows	UHV						

* PSS Status Indicator: I-interlocked, A-administratively controlled, M-mode controlled

** EPS Status Indicator: Y-yes, N-no, X-not applicable

Table 3 (continued)

Part#	Description	Vac. Status	PSS Status	EPS Status				Comments
				Water flow	Posit-ion	Vac.	Temp	
12ID52	P4-20 Shutter	UHV	M/I	Y		Y	Y	APS STD Component
12ID55	Adapter 14-8	UHV						
12ID57	Collimator	UHV	A					Part of Bremm. Shielding
12ID58	V2-91 Bellows	UHV			Y			
12ID59	Gate Valve	UHV						Position Controlled by EPS
12ID61	Transition Pipe	UHV	A					End of FOE
12ID62	U1 Bellows	UHV						Inside Shielded Enclosure
12ID64	Shielded Pipe	UHV	A					
12ID66	Shielded Pipe	UHV	A					
12ID67	U1 Bellows	UHV						Inside Shielded Enclosure
12ID69	Shielded Pipe	UHV	A					
12ID70	Pump Out	UHV						Inside Shielded Enclosure
12ID71	Ion Pump, 120 l/s	UHV				Y		Inside Shielded Enclosure
12ID73	U1 Bellows	UHV						Inside Shielded Enclosure
12ID74	Shielded Pipe	UHV	A					
12ID76	Shielded Pipe	UHV	A					
12ID77	U1 Bellows	UHV						Inside Shielded Enclosure
12ID79	Shielded Pipe	UHV	A					

Table 3 (continued)

Part#	Description	Vac. Status	PSS Status	EPS Status				Comments
				Water flow	Posit-ion	Vac.	Temp	
12ID82	U1 Bellows	UHV						Inside Shielded Enclosure
12ID83	Gate Valve	UHV			Y			controlled by EPS
12ID84	L2-20 Slits	UHV				Y		APS STD Component
12ID85	In-Line Pump, 120l/s	UHV				Y		Inside Shielded Enclosure
12ID86	Beam Profile Monitor, 6-Way Cross	UHV						"
12ID88	Bellows	UHV						"
12ID89	Shielded Pipe	UHV						Inside Shielded Enclosure
12ID91	W4-20 Be Window	UHV		Y			Y	Inside 12-ID-B Hutch
12ID94	Gate Valve	UHV						EPS Control
12ID95	P8-20 Shutter	UHV						APS STD Component
12ID98	Shielded Pipe	UHV						Inside Shielded Enclosure
12ID 100	W4-20 Be Window	UHV		Y			Y	Inside 12-ID-C Hutch
12ID 103	Gate Valve	UHV						EPS Control
12ID 104	P8-20 Shutter	UHV						APS STD Component
12ID 107	Shielded Pipe	UHV						Inside Shielded Enclosure
12ID 109	W4-20 Be Window	UHV		Y			Y	Inside 12-ID-D Hutch

Vacuum Status

The 12-ID beamline is designed to be in compliance with the APS Vacuum Policy (Oct., 1994). Table 3 gives the Vacuum status for each component in the 12-ID beamline. This table uses the definitions of vacuum status which are described in the APS vacuum policy: vacuum trips are set at 1×10^{-8} Torr for UHV, 1×10^{-6} Torr for HV, 1×10^{-3} Torr for MHV.

Schedule

Installation Schedule

The installation schedule for the 12-ID beamline are given in Appendix C.

Procurement Schedule

The projected delivery dates for all standard components is available from the APS staff. Since these components are purchased through the APS this listing is maintained by APS staff. Component installation dates as given in Appendix C may vary as the procurement schedule is updated. The non-standard components, i.e. the BESSRC monochromator and monochromator support table, are already on site.

APS Support Schedules

Utility Installation

Utilities will be installed on the 12-ID beamline as the enclosures are constructed. Construction of the 12-ID-D enclosure is expected in March of 1996. Construction of the remaining enclosures, 12-ID-C and 12-ID-B, is expected in June and July of 96 (see APS Procurement schedule for updates of installation times). Installation of utilities between the ID and BM station will be done after all the ID stations are finished.

Survey & Alignment

The schedules for survey and alignment by the APS Survey and Alignment Group are given in Table 4. These schedules are based on the predicted delivery dates of major components and therefore may change if delivery dates are not met.

PSS Installation and Checkout Schedule

PSS installation for the 12-ID-A enclosure is presently underway. Installation of the PSS hardware along the beamline and on the 12-ID-B, 12-ID-C and 12-ID-D enclosures will be required soon after each of the enclosures is finished.

Table 4. 12-ID Survey and Alignment Schedule

Component	Part #	Projected Survey Date
Collimator	K1A & K1B	9/96
White Light ID Filter Assembly	F2-30	9/96
White Light ID Slit Assembly	L5-20	9/96
ID Shutter/ White Beam Stop	P4-20	9/96

Safety

Personnel Safety System(PSS)

Interlocked Components

The components which are interlocked as part of the PSS system are given in Tables 3 and 5. The designations "**I**" imply an Interlocked Control procedure, "**A**" means an Administratively Controlled component and "**M**" stands for a Mode Controlled (Kirk Key) controlled device.

Table 5. Identification of Interlocked Components.

Component	Part #	PSS Status
12-ID-A Enclosure		I
White Beam Stop / Monochromatic Shutter	P4-20	I M
12-ID-B Enclosure		I
Monochromatic Shutter	P8-20	I
12-ID-C Enclosure		I
Monochromatic Shutter	P8-20	I
12-ID-D Enclosure		I

Administratively Controlled Components

Those components where access will be controlled by administrative means include the shielded pipe stands, small shielded pump enclosure located in the transport section of the beamline and the enclosure for the L2-20 Slits locateD immediately in front of the 12-ID-B enclosure. The method by which these enclosures will be secured and type of controls to be used will be discussed with the APS staff and will be part of the beamline commissioning documentation.

In addition, procedures by which the beam will pass through the 12-ID-B enclosure and be used in the 12-ID-C station and similarly through both the B and C stations to enter the 12-ID-D experimental station must be established. As was stated in the PDR, in initial operations an unshielded vacuum pipe will be placed inside the stations. The hutches will then be interlocked to pass the beam to the subsequent stations. The implementation of some sort of "pass thru" mode using shielded pipe will not be discussed in this document but will be left for future beamline development when there is some experience with this mode of operations. In either case, the locations (heights) of the P8 shutters which serve as backstops in the 12-ID-B and 12-ID-C experimental stations and the placement of shielded or unshielded pipe in the 12-ID-B and 12-ID-C stations will be controlled with administrative procedures.

Location of PSS Hardware

Details of PSS hardware locations for the FOE are given in Fig. 10 while PSS hardware locations for the 12-ID-B, 12-ID-C and 12-ID-D enclosures appear in Fig. 11, Fig. 12, and Fig. 13, respectively.

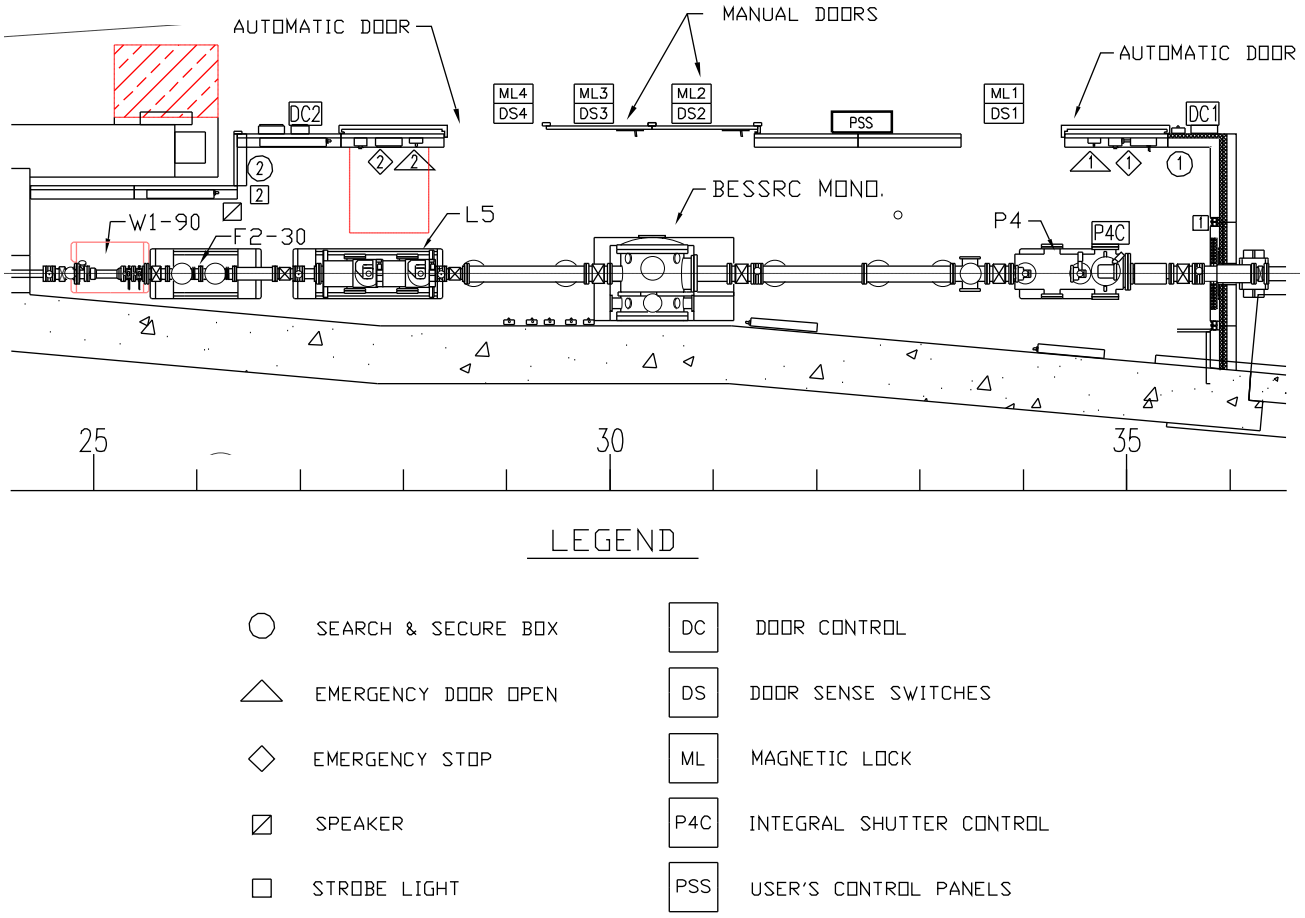

Figure 10 PSS component locations in the 12-ID-A (FOE) enclosure.

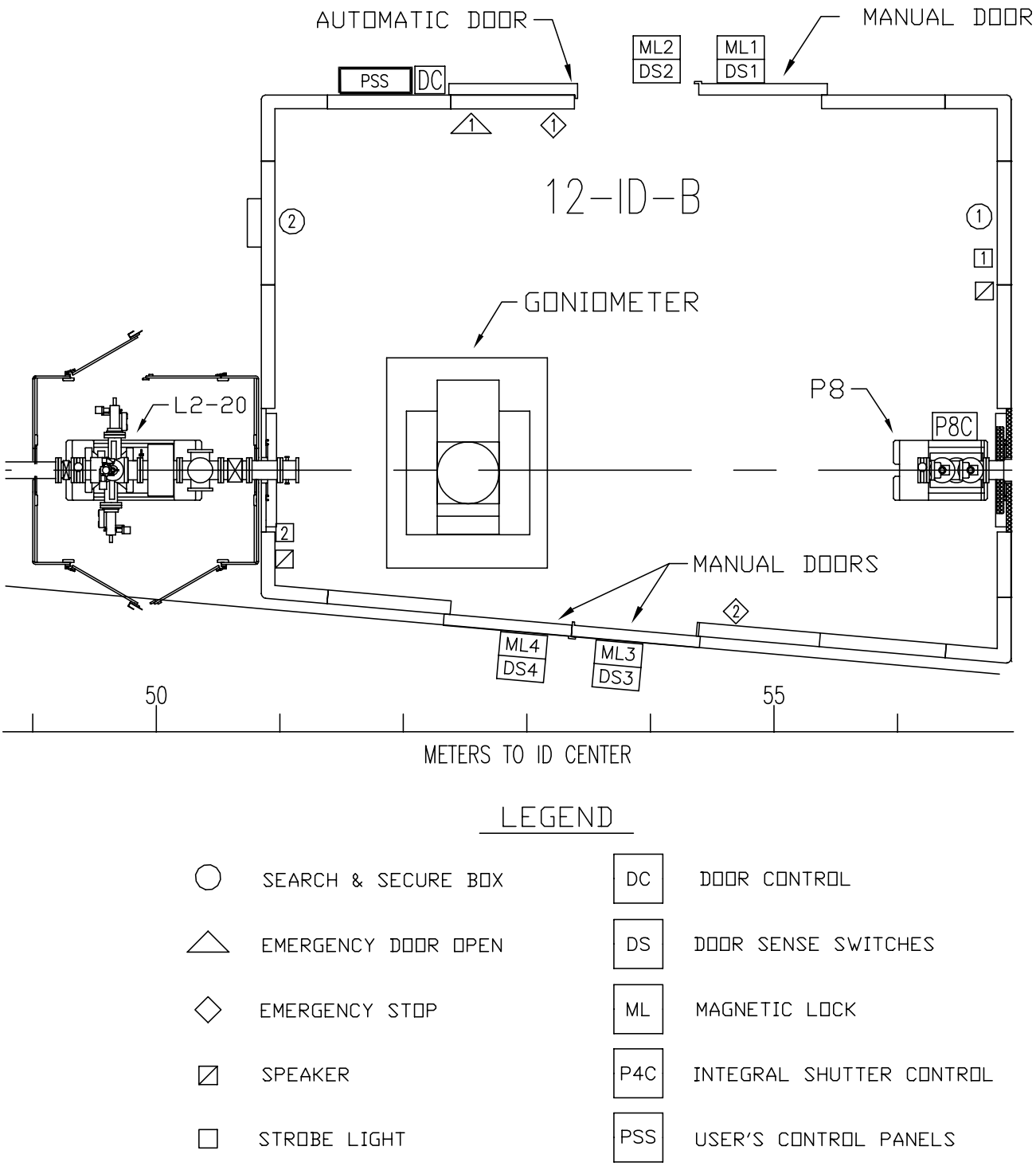

Figure 11 PSS component locations in the 12-ID-B enclosure.

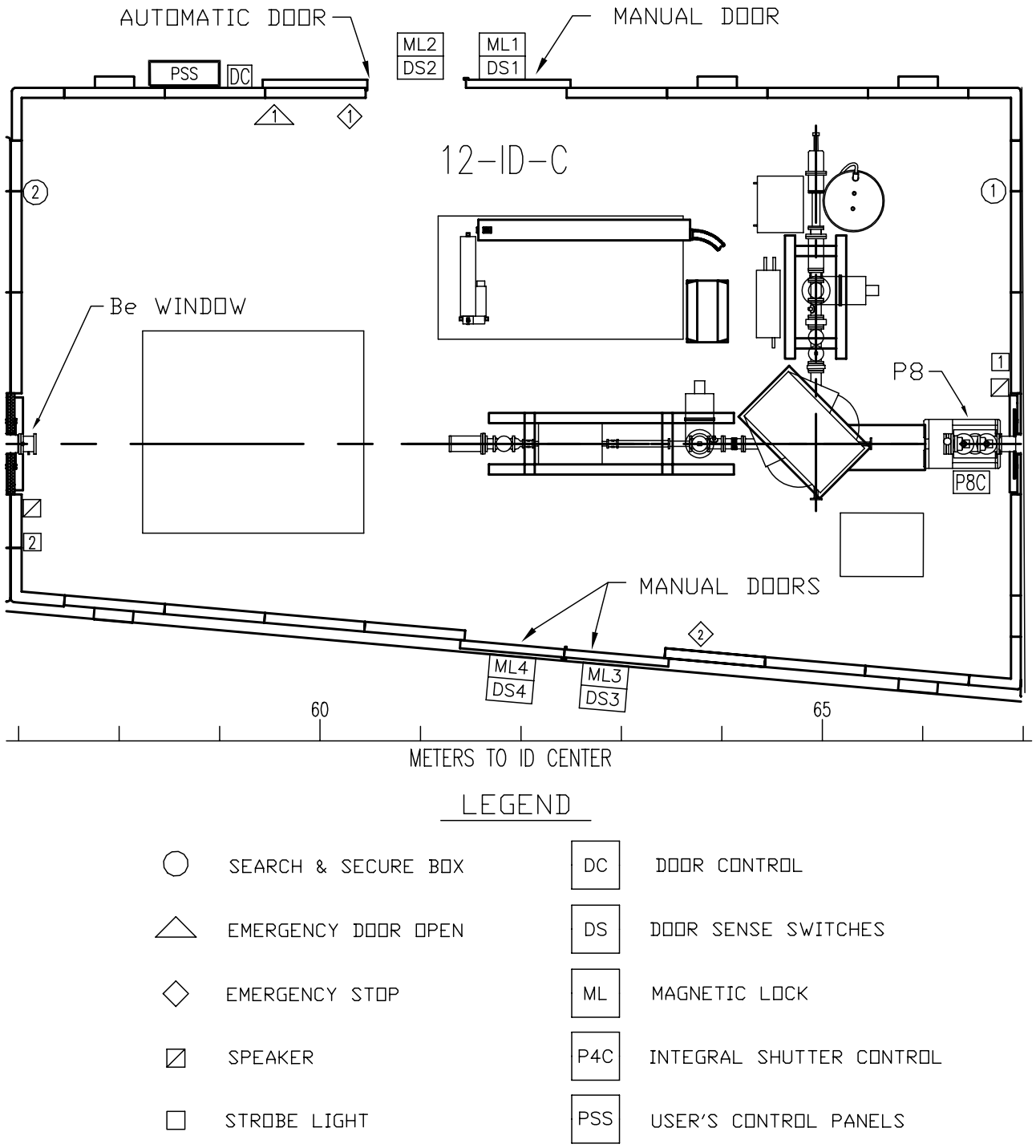

Figure 12 PSS component locations in the 12-ID-C enclosure.

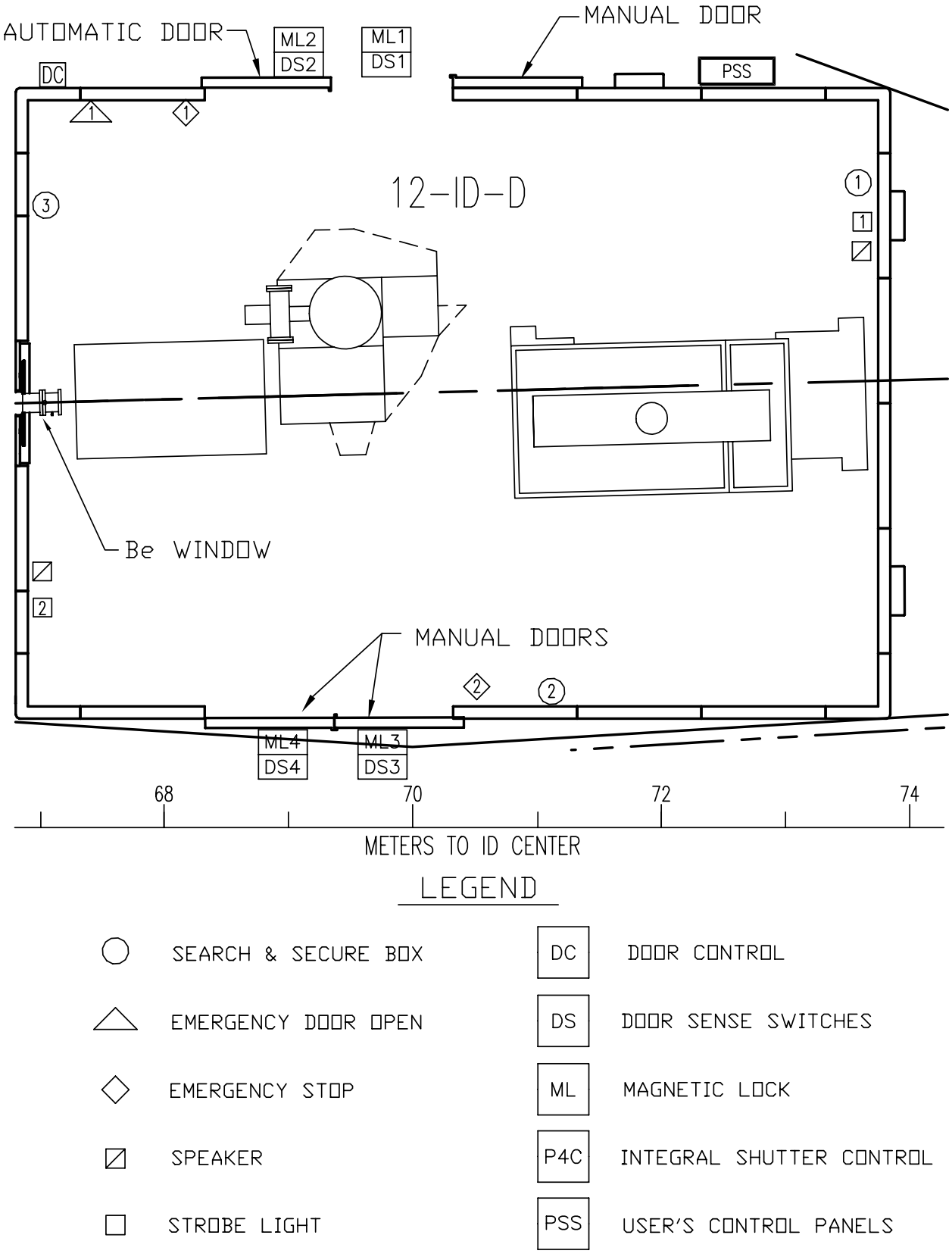

Figure 13. PSS component locations in the 12-ID-D enclosure.

Table 6. PSS Logic for different modes of operation.

Component Status Beamline Mode (Phase 1 - no Mirror)	P4-20 Photon Stop In	P4 Brems. Stop In	P4 Mono Shutter In (Closed)	P8-20 in 12-ID-B In(Closed)	P8-20 in 12-ID-C In (Closed)
12-ID-A (FOE) Online	T	T	T	X	X
12-ID-A and Mono Beam in 12-ID-B	T	T	F	T	X
12-ID-A and Mono Beam in 12-ID-B and 12-ID-C	T	T	F	F	T
12-ID-A and Mono Beam in B, C and D enclosures	T	T	F	F	F
Beamline Mode (Phase 2 Mirror in line)					
12-ID-A Online	T	T	T	X	X
12-ID-A online and Mono Beam in 12-ID-B	T	T	F	T	X
12-ID-A online and Pink Beam in 12-ID-B	F	F	F (locked)	T	X
12-ID-A online and Mono Beam in B and C	F	F	F (locked)	F	T
12-ID-A online and Pink Beam in B and C	F	F	F (locked)	F	T
12-ID-A and Mono Beam in B, C and D	F	F	F (locked)	F	F
12-ID-A online and Pink Beam in B, C and D	F	F	F (locked)	F	F
T-True, F-False, X-Component Status does not affect beam					

Beamline Mode Logic

Table 6 provides the PSS logic for the different modes of operation for the 12-ID beamline. The first column in the table shows a beamline mode, and each of the succeeding columns shows the status of a particular component for that given mode. The positions of the P4-20 Photon Stop and P4-20 Bremsstrahlung Stop are to be changed by switching Kirk keys between the shutter assembly and a control panel. Table 6 also gives the logic diagrams for the 12-ID beamline after the installation of a mirror in the FOE.

Experimental Station Logic

Tables 7 and 8 give the PSS logic for the 12-ID-A , B, C and D experimental stations. The format is the same as that given in the SRI CAT Sector 1 FDR; i.e. the first column in the table gives the desired beamline status and the subsequent columns show the states of the components required to produce that status. In Phase 1 of beamline operation (that is without a mirror) and in Phase 2 (with a mirror), the nine possible user actions are identical.

These are:

1. Bring beam into the 12-ID-A enclosure.
2. Bring beam into the 12-ID-A enclosure and the 12-ID-B enclosure.
3. Bring beam into the 12-ID-B enclosure when it is already entering the 12-BM-A enclosure.
4. Bring beam into the 12-ID-C enclosure when it is already entering the 12-ID-A and 12-ID-B enclosures.
5. Bring beam into the 12-ID-D enclosure when it is already entering the 12-ID-A, 12-ID-B and 12-ID-C enclosures.
6. Enter the 12-ID-D enclosure.
7. Enter the 12-ID-C enclosure.
8. Enter the 12-ID-B enclosure.
9. Enter the 12-ID-A enclosure.

Table 7 gives the status of components required for monochromatic beamline operation (Phase 1 & Phase 2) while Table 8 gives the states of components and subcomponents for pink beam operation (Phase 2).

Table 7. PSS Logic for Monochromatic operation.

Component Status Beamline Status	A Secure	B Secure	C Secure	D Secure	Front Shutter Closed	P4-20 Photon Stop In	P4 Brems. Stop In	P4 Mono Shutter Closed	P8B* Mono Shutter Closed	P8C* Mono Shutter Closed
Beam into 12-ID-A	T	X	X	X	O T⇒F	T/M	T/M	T	T	T
Beam into 12-ID-B	T	T	X	X	O T⇒F	T/M	T/M	O T⇒F	T	T
Beam into 12-ID-C	T	T	T	X	O T⇒F	T/M	T/M	O T⇒F	O T⇒F	T
Beam into 12-ID-D	T	T	T	T	O T⇒F	T/M	T/M	O T⇒F	O T⇒F	O T⇒F
Beam into B when in A	T	T	X	X	F	T/M	T/M	O T⇒F	T	T
Beam into C when in A	T	T	T	X	F	T/M	T/M	O T⇒F	O T⇒F	T
Beam into D when in A	T	T	T	X	F	T/M	T/M	O T⇒F	O T⇒F	O T⇒F
Beam into C when in A and B	T	T	T	X	F	T/M	T/M	F	O T⇒F	T
Beam into D when in A and B	T	T	T	T	F	T/M	T/M	F	O T⇒F	O T⇒F
Beam into D when in A,B and C	T	T	T	T	F	T/M	T/M	F	F	O T⇒F

T-True, F-False, O- Component which is changing state, X-Component Status does not affect beam, T⇒F means the component changes state so that the Status changes from True to False, #1 indicates preferred option, #2, 3 and 4 are other less desirable options.
* normal state of P8 shutter is closed

Table 7. PSS Logic for Monochromatic operation (continued)

Component Status Beamline Status	A Secure	B Secure	C Secure	D Secure	Front Shutter Closed	P4-20 Photon Stop In	P4 Brems. Stop In	P4 Mono Shutter Closed	P8B* Mono Shutter Closed	P8C* Mono Shutter Closed
Access to 12-ID-A	O	X	X	X	O F⇒T	T/M	T/M	T	T	T
Access to B, #1	T	O	X	X	F	T/M	T/M	O F⇒T	T	T
Access to B, #2	T	O	X	X	O F⇒T	T/M	T/M	F	T	T
Access to C, #1	T	T	O	X	F	T/M	T/M	F	O F⇒T	T
Access to C, #2	T	T	O	X	F	T/M	T/M	O F⇒T	O F⇒T	T
Access to C, #3	T	T	O	X	O F⇒T	T/M	T/M	O F⇒T	O F⇒T	T
Access to D, #1	T	T	T	O	F	T/M	T/M	F	F	O F⇒T
Access to D, #2	T	T	T	O	F	T/M	T/M	F	O F⇒T	O F⇒T
Access to D, #3	T	T	T	O	F	T/M	T/M	O F⇒T	O F⇒T	O F⇒T
Access to D, #4	T	T	T	O	O F⇒T	T/M	T/M	O F⇒T	O F⇒T	O F⇒T

T-True, F-False, O- Component which is changing state, X-Component Status does not affect beam, T⇒F means the component changes state so that the Status changes from True to False, #1 indicates preferred option, #2 ,3 and4 are other less desirable options.
* normal state of P8 shutter is closed

Table 8. PSS Logic for Pink Beam operation (mirror in place, Phase 2)

Component Status Beamline Status	A Secure	B Secure	C Secure	D Secure	Front Shutter Closed	P4-20 Photon Stop In	P4 Brems. Stop In	P4 Mono Shutter Closed	P8B* Mono Shutter Closed	P8C* Mono Shutter Closed
Beam into 12-ID-A	T	X	X	X	O T⇒F	T	T	X/M	T	T
Beam into 12-ID-B	T	T	X	X	O T⇒F	O T⇒F	O T⇒F	X/M	T	T
Beam into 12-ID-C	T	T	T	X	O T⇒F	O T⇒F	O T⇒F	X/M	O T⇒F	T
Beam into 12-ID-D	T	T	T	T	O T⇒F	O T⇒F	O T⇒F	X/M	O T⇒F	O T⇒F
Beam into B when in A	T	T	X	X	O T⇒F	O T⇒F	O T⇒F	X/M	T	T
Beam into C when in A	T	T	T	X	O T⇒F	O T⇒F	O T⇒F	X/M	O T⇒F	T
Beam into D when in A	T	T	T	X	O T⇒F	O T⇒F	O T⇒F	X/M	O T⇒F	O T⇒F
Beam into C when in A and B	T	T	T	X	O T⇒F	F	F	X/M	O T⇒F	T
Beam into D when in A and B	T	T	T	T	O T⇒F	F	F	X/M	O T⇒F	O T⇒F
Beam into D when in A,B and C	T	T	T	T	O T⇒F	F	F	X/M	F	O T⇒F

T-True, F-False, O- Component which is changing state, X-Component Status does not affect beam, T⇒F means the component changes state so that the Status changes from True to False, #1 indicates preferred option, #2, 3 and 4 are other less desirable options.
* normal state of P8 shutter is closed

Table 8. PSS Logic for Pink Beam operation (mirror in place, Phase 2) (continued).

Component Status Beamline Status	A Secure	B Secure	C Secure	D Secure	Front Shutter Closed	P4-20 Photon Stop In	P4 Brems. Stop In	P4 Mono Shutter Closed	P8B* Mono Shutter Closed	P8C* Mono Shutter Closed
Access to 12-ID-A	O	X	X	X	O F⇒T	T	T	X/M	T	T
Access to B, #1	T	O	X	X	F	O F⇒T	O F⇒T	X/M	T	T
Access to B, #2	T	O	X	X	O F⇒T	O F⇒T	O F⇒T	X/M	T	T
Access to C, #1	T	T	O	X	O T⇒F	F	F	X/M	O F⇒T	T
Access to C, #2	T	T	O	X	O T⇒F	O F⇒T	O F⇒T	X/M	O F⇒T	T
Access to C, #3	T	T	O	X	O F⇒T	O F⇒T	O F⇒T	X/M	O F⇒T	T
Access to D, #1	T	T	T	O	O T⇒F	F	F	X/M	F	O F⇒T
Access to D, #2	T	T	T	O	O T⇒F	F	F	X/M	O F⇒T	O F⇒T
Access to D, #3	T	T	T	O	O T⇒F	O F⇒T	O F⇒T	X/M	O F⇒T	O F⇒T
Access to D, #4	T	T	T	O	O F⇒T	O F⇒T	O F⇒T	X/M	O F⇒T	O F⇒T

T-True, F-False, O- Component which is changing state, X-Component Status does not affect beam, T⇒F means the component changes state so that the Status changes from True to False, #1 indicates preferred option, #2 ,3 and 4 are other less desirable options.
* normal state of P8 shutter is closed

Equipment Protection System (EPS)

The primary purpose of the beamline Equipment Protection System (EPS) is to ensure that beamline components are protected from beam related damage. To perform this function, the beamline EPS monitors parameters such as water (flow, pressure, and temperature), beamline vacuum levels and critical components (position, temperature, and operational mode) at key points along the beamline. If and when a parameter falls outside of its preset operating range, an interlock trip will result and a shutter and/or valve located upstream of the fault will be closed. For white-beam components, this fault is communicated to the front-end EPS, which signals the Personnel Safety System (PSS) to close the front-end safety shutters. For faults affecting other beamline components, the shutter to be closed is specified as part of the beamline EPS logic. Beamline vacuum faults will signal the EPS to isolate beamline segments by closing the appropriate pneumatically activated VAT valves.

The EPS logic will be implemented using Koyo Programmable Logic Controllers (PLCs). The inputs to the PLCs (logical and otherwise) will come from the PSS, the front end EPS, EPS control panels and from parameters measured along the beamline. Signals from the beamline are channeled directly into Koyo I/O terminal blocks (for analog, DC, and thermocouple input) or initially to process controllers which are then read out by the PLCs. The logical outputs from the PLCs are communicated to the front end EPS, to the beamline VAT valves, and to EPS control/display panels located on the beamline.

Each of the parameters (e.g., temperature, flow, pressure) to be monitored along the beamline is measured by a Koyo DL405 CPU PLC connected to the various I/O blocks. When parameters falls outside their set points (as defined in the beamline EPS logic), the PLCs communicate an open contact to the PSS and front end EPS. The current state of the PLCs will also be updated on the EPS control/display panel. Additionally, the value of each parameter can be read by a beamline computer by direct communication with the PLC through a dedicated serial line. These parameters can then be stored in soft records in a beamline VME crate via EPICS Channel Access (CA) after which they may be manipulated as normal EPICS process variables. Table 3 indicates which components are monitored by the EPS. The general type of monitoring is shown (coolant, temperature, vacuum, or position), along with special considerations (shown in the comments). In addition, on ID beamlines, the ID gap and storage-ring current are monitored and used to determine which configurations of the user filters are permissible and to prevent operation if these conditions are not met.

The EPS hardware will be located in racks outside the 12-ID enclosures. Rack mounted Koyo PLCs, I/O bricks, block I/O modules, and the EPS status and control panels as well as any specialized process controllers will be located close to the egress points of the enclosures. .

Beamline Shielding

The shielding for the 12-ID experimental stations and transport sections meets all requirements set forth in ANL/APS/TB-7, ANL/APS/TB-20 and subsequent ANL/XFD Radiation Safety documents.

Ozone Mitigation Procedures

The calculations of ozone production rates from monochromatic or pink beam done for the BESSRC CAT PDR showed that ozone concentrations will be negligible in all the BESSRC experimental stations. If ozone appears to be a problem in ID beamlines commissioned before the 12-ID line is comissioned, mitigation procedures will be implemented during beamline commissioning.

Safety Hazards

Chemical and electrical safety hazards in the 12-ID experimental stations, on the beamline and in the BESSRC CAT LOM were previously discussed in the preliminary BESSRC CAT Safety Plan and will be readdressed in the final BESSRC CAT Safety documents.

Fire Safety

The designs for the 12-ID enclosures and transport do not include significant fire hazards. The policies and procedures for assessing and mitigating any fire hazard on the 12-ID beamline will be addressed in the final BESSRC CAT Safety documents.

Special Operations Requirements

When allowed by the APS, the 12-ID beamline will operate as a windowless beamline from the FOE to the 12-ID-D enclosure..

Appendix A

List of Beamline Drawings

Figure 1. Plan and elevation views of the 12-ID beamline.
12IDVIEW.DWG *

Figure 2 Top view of bending magnet and insertion device beamlines on sector 12.
SECT12.DWG *

Figure 3. Top and side views of 12-ID-A (FOE). Major components are noted in the top view.
A. FOE Drawings, top and side views.
F12ID-A.DWG
Detailed drawings for the 12-ID-A experimental station are
H17500-1 thru H17500-9*

Figure 4. Transport section of the 12-ID beamline.
F12ID-T.DWG*

Figure 5. Plan and elevation views of the 12-ID-B experimental hutch.
A. Top and side views
F12ID-B.DWG*
Detailed drawings for the 12-ID-B experimental station are
12IDBINS*
12IDBOUT*
12IDB-RF*

Figure 6. Plan and elevation views of the 12-ID-C experimental hutch.
A. Top and side views
F12ID-C.DWG*
Detailed drawings for the 12-ID-B experimental station are
12IDCINS*
12IDCOUT*
12IDC-RF*

* Drawings in BESSRC CAT Beamline Review Library on the APS Design Exchange.

* Drawings in BESSRC CAT Beamline Review Library on the APS Design Exchange.

Figure 7. Plan and elevation views of the 12-ID-D experimental hutch.
A. Top and side views
F12ID-D.DWG*
Detailed drawings for the 12-ID-B experimental station are
12-ID-D*
A22890-1 thru A22890-9**
A2289010 and A2289011**

Figure 8. Utility layout for Sector 12. Top view of the cable tray layout for both the Bending Magnet and Insertion Device beamlines is shown.

Cable Trays	12TRAYVW.DWG*
Electrical Power	12DUCTVW.DWG*
Water	12WATRVW.DWG*
Air	12AIRVW.DWG*

Figure 9. Ray tracing for the 12-ID beamline.
A. Horizontal Ray tracing for the 12-ID beamline
B. Vertical Ray tracing, monochromator only
C. Vertical Ray tracing, mirror only
D. Vertical Ray tracing, monochromator and mirror

Figure 10. PSS component locations in the 12-ID-A (FOE) enclosure
PSS12IDA.DWG*

Figure 11. PSS component locations in the 12-ID-B (FOE) enclosure
PSS12IDB.DWG*

Figure 12 PSS component locations in the 12-ID-C enclosure.
PSS12IDC.DWG*

Figure 13 PSS component locations in the 12-ID-D enclosure.
PSS12IDD.DWG*

** Drawings in the General Library on the APS Design Exchange

Appendix B

List of Components

BLine Cmpnt #	X(mm)	Description	Source	P_Req/Cntrct	Est_del
12-ID.0.	16000	Front End for Undulator Beamline	APS	APS_Rspnsblty	Installed
12-ID.0.2	24392	Ratchet Wall: Undulator First Optics Enclosure (FOE)	APS	Aw: 1/25/95	Delivered
12-ID.0.3	24542	All-Metal, UHV Gate Valve	APS	APS_Rspnsblty	Installed
		Configuration for Commissioning			
12-ID.0.4	24612	Welded Bellows (% APS Front End)	APS	APS_Rspnsblty	
12-ID.0.5	24812	ID Front-End Commissioning Filter-Mask Assembly	APS	APS_Rspnsblty	
12-ID.0.6	24909	APS Undulator W/B H&V Slits Fixed-Mask Assembly	APS	APS_Rspnsblty	
12-ID.0.7		T1 ID Front-End Differential-Pump Support Assembly	APS	APS_Rspnsblty	
12-ID.0.8	25264	ID Front-End Commissioning Be-Window Assembly	APS	APS_Rspnsblty	
12-ID.0.9	25364	ID Front-End Commissioning Be-Window Assembly	APS	APS_Rspnsblty	
12-ID.0.10	25464	Welded Bellows (% APS Front End)	APS	APS_Rspnsblty	
	25720	**Beginning of User-Accessible Portion of Undulator Beamline**			
		Filters & Collimator			
12-ID.0.12		Table for F2-30s & K1A	APS	Aw: 3/22/95	Rcvd/QA
12-ID.0.13	25720	Filters (ID Wh Light)	APS	Aw: 4/19/95	Rcvd/QA
12-ID.0.14	25970	Welded Bellows	Std Bellows		Rcvd
12-ID.0.15	26045	Filters (ID Wh Light)	APS	Aw: 4/19/95	Rcvd/QA
12-ID.0.16	V	Pump-Out Spool, with vac gauges, valve, & fittings	MDC		Rcvd
12-ID.0.17	V	Ion Pump, 220 L/s, Tall	P E	Aw: 2/21/95	Rcvd
12-ID.0.18	26295	Welded Bellows	Std Bellows		Rcvd
12-ID.0.19	26370	1st FOE Collimator (Und A Wh Light)	MDC	Ex. Aw: 6/96	
12-ID.0.20	26760	Formed Bellows, 3.5" ID, 6"x6"-195	MDC		Rcvd
12-ID.0.21	26955	Gate Valve	VAT	Aw:2/9/95	Rcvd
		Fixed Mask & Slits			
12-ID.0.22		Table for Fixed Mask, L5-20, & G Vlv	APS	Aw: 7/12/95	Rcvd/QA

BLine Cmpnt #	X(mm)	Description	Source	P_Req/Cntrct	Est_del
12-ID.0.23	27025	Fixed Mask, Config. "B"	APS	Aw: 6/13/95	6/15/96
12-ID.0.24	27165	Adapter Flange, zero-length, 6" to 8"	APS	Aw: 6/13/95	6/15/96
12-ID.0.25	27187	Slits (Undulator A Wh Light)	APS	Aw: 6/13/95	6/15/96
12-ID.0.26	V	Pump-Out Spool	MDC		Rcvd
12-ID.0.27	V	Ion Pump, 220 L/s, Tall	P E	Aw: 2/21/95	Rcvd
12-ID.0.28	28334	Gate Valve	VAT	Aw: 2/9/95	Rcvd
12-ID.0.29	28404	Formed Bellows, 3.5" ID, 6"x6"-195	MDC		Rcvd
12-ID.0.30	28599	Adapter Flange, zero-length, 6" to 8"	MDC		Rcvd
12-ID.0.31	28621	Unshielded Transport Pipe, 6" O.D.	BESSRC	Aw: 5/96	
12-ID.0.32	C28721	Unshielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.33	C29672	Unshielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.34	29772	Formed Bellows, 5.5" ID, 8"x8"-230	MDC		Rcvd
		Monochromator			
12-ID.0.35		Table for BESSRC Monochromator	AJR		Rcvd
12-ID.0.36	30002	BESSRC Monochromator Chamber, version 1	MDC		Rcvd
12-ID.0.37	V	Tee for "HV" Side	MDC		Rcvd
12-ID.0.38	V	Ion Pump, 170 L/s, Tall	P E		Rcvd
12-ID.0.39	V	Tee for "UHV" Side	MDC		Rcvd
12-ID.0.40	V	Ion Pump, 220 L/s, with NEG	P E		Rcvd
12-ID.0.41	30815	Unshielded Adapter,	BESSRC	Shops 5/96	
12-ID.0.42	31159	Formed Bellows, 5.5" ID, 8"x8"-230	MDC		Rcvd
12-ID.0.43	31389	Gate Valve	VAT	Aw:2/9/95	Rcvd
12-ID.0.44	31459	Unshielded Transport Pipe, 6" O.D.,	BESSRC	Aw: 5/96	
12-ID.0.45	C31559	Unshielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.46	C32359	Unshielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.47	32459	Unshielded Transport Pipe, 6" O.D.	BESSRC	Aw: 5/96	
12-ID.0.48	C33217	Unshielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.49	33317	6-Way Cross (Possible use as B Prof. Mon.)	MDC	Aw: 5/96	
12-ID.0.50	33650	Formed Bellows, 5.5" ID, 8"x8"-230	MDC		

BLine Cmpnt	X(mm)	Description	Source	P_Req/Cntrct	Est_del
		Integral Shutter			
12-ID.0.51		Table for P4-20	APS	Aw: 3/22/95	Rcvd/QA
12-ID.0.52	33880	Integral Shutter (ID, Wh or Monochrom Light)	APS	Aw: 8/4/95	Rcvd/QA
12-ID.0.53	V	Pump-Out Spool, with vac gauges, valve, & fittings	MDC		
12-ID.0.54	V	Ion Pump, 220 L/s, Tall	P E	Aw: 2/21/95	Rcvd/QA
12-ID.0.55	35011	Adapter Flange, 14" to 8"	APS	Aw: 8/20/95	Rcvd
12-ID.0.56		Support Shelf for 2nd FOE Collimator	BESSRC	ANL Shop	
12-ID.0.57	35039	2nd FOE Collimator (Und A Wh Light)	MDC	Ex. Aw: 5/96	
12-ID.0.58	35429	Formed Bellows, 5.5" ID, 8"x8"-230	MDC		Rcvd
12-ID.0.59	35659	Gate Valve	VAT	Aw: 2/9/95	Rcvd
12-ID.0.60		Support Shelf for Bellows & Gate Valve	BESSRC	Shop 5/96	
12-ID.0.61	35729	Shielded Transition Pipe, 4" I.O.D., for IDs	APS	Aw: 5/96	
12-ID.0.	36057	End of FOE			
		Shld'd Beam-Xport Pipes			
12-ID.0.62	36229	Welded Bellows	Std Bellows		Rcvd
12-ID.0.63	C36292	Shld'd Support Stand	BESSRC	Aw: 5/96	
12-ID.0.64	36354	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
12-ID.0.65	C38354	Shld'd Support Stand	BESSRC	Aw: 5/96	
12-ID.0.66	38354	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
12-ID.0.67	40354	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	Std Bellows		Rcvd
12-ID.0.68	C40416	Shld'd Support Stand	BESSRC	Aw: 5/96	
12-ID.0.69	40479	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
		Pumping Station			
12-ID.0.70	42479	Pump-Out Spool, with vac gauges, valve, & fittings	MDC		
12-ID.0.71	42639	Inline Ion Pump, 120 L/s	P E	Aw: 2/21/95	Rcvd
12-ID.0.72	C42800	Shielded Support Stand	BESSRC	Aw: 5/96	
12-ID.0.73	42960	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	Std Bellows		Rcvd
12-ID.0.74	43085	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
		Shld'd Beam-Xport Pipes			
12-ID.0.75	C45085	Shld'd Support Stand	BESSRC	Aw: 5/96	
12-ID.0.76	45085	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
12-ID.0.77	47085	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	Std Bellows		
12-ID.0.78	C47148	Shld'd Support Stand	BESSRC	Aw: 5/96	
12-ID.0.79	47210	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days

BLine Cmpnt #	X(mm)	Description	Source	P_Req/Cntrct	Est_del
		Diagnostics Cabinet			
12-ID.0.80	49022	ID Shielded Dignstcs Cabnt	APS	Aw: 4/15	120 days
12-ID.0.81		Table for L2-20	APS	Aw:3/22/95	Rcvd/QA
12-ID.0.82	49210	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	Std Bellows		
12-ID.0.83	49335	Gate Valve	VAT	Aw: 2/9/95	Rcvd
12-ID.0.84	49405	Slits (Undulator Monochrom Light)	APS	Aw: 6/14/95	2/15/96
12-ID.0.85	49870	Inline Ion Pump, 120 L/s	P E	Aw: 2/21/95	Rcvd
12-ID.0.86	50191	6-Way Cross (Possible use as B Prof. Mon.)	MDC	Exp Aw: 5/96	
12-ID.0.87	V	Pump-Out Spool, with vac gauges, valve, & fittings	MDC	Exp Aw: 5/96	
12-ID.0.88	50524	Formed Bellows, 5.5" ID, 8"x8"-230	MDC	Exp Aw: 5/96	
12-ID.0.89	50754	Shielded Transport Pipe, 4" I.O.D., for IDs	APS	Aw: 4/15	120 days
	50851	End of Diagnostics Cabinet			
		12 ID-B Enclosure			
12-ID.0.90	50851	Exptal Hutch 12-ID-B	APS	Aw: 2/29/96, Del 8/96	
12-ID.0.91	51254	Be Window	BESSRC	Exp Aw: 5/96	
12-ID.0.92		Support Shelf for W2-40	BESSRC	Shop 5/96	
12-ID.0.93		Table for Gate Valve, P8-20, & 120 L/s Ion Pump	APS	Aw: 9/13/95	Rcvd/QA
12-ID.0.94	56169	Gate Valve	VAT	Aw: 2/9/95	Rcvd
12-ID.0.95	56239	Photon Shutter	APS	Aw: 8/4/95	Rcvd/QA
12-ID.0.96	V	Pump-Out Spool, with vac gauges, valve, & fittings	MDC		Rcvd
12-ID.0.97	V	Ion Pump, 120 L/s	P E	Aw: 2/21/95	Rcvd
12-ID.0.98	56722	Shielded Transition Pipe, 4" I.O.D., for IDs	APS	Ex Aw: 5/96	
	56920	End of Exptal Hutch 12 ID-B			
		12 ID-C Enclosure			
12-ID.0.99	56920	Exptal Hutch 12-ID-C	APS	Exp Aw: 2/2/96	8/96
12-ID.0.100	57022	Be Window	BESSRC	Exp Aw: 5/96	
12-ID.0.101		Support Shelf for W2-40	BESSRC	Shop 5/96	
12-ID.0.102		Table for Gate Valve, P8-20, & 120 L/s Ion Pump	APS	Aw: 9/13/95	Rcvd/QA
12-ID.0.103	66230	Gate Valve	VAT	Aw: 2/9/95	Rcvd
12-ID.0.104	66300	Photon Shutter	APS	Aw: 8/4/95	Rcvd/QA
12-ID.0.105	V	Pump-Out Spool, with vac gauges, valve, & fittings	MDC		Rcvd
12-ID.0.106	V	Ion Pump, 120 L/s	P E	Aw: 2/21/95	Rcvd

BLine Cmpnt	X(mm)	Description	Source	P_Req/Cntrct	Est_del
12-ID.0.107	66783	Shielded Transition Pipe, 4" I.O.D., for IDs	APS	Aw: 5/96	
	66976	End of Exptal Hutch 12 ID-C			
		12 ID-D Enclosure			
12-ID.0.108	67039	Exptal Hutch 12-ID-D	APS	Aw: 11/21/95	5/96
12-ID.0.109	67133	Be Window	BESSRC	Exp Aw: 5/96	
12-ID.0.110		Support Shelf for W2-40	BESSRC	Shop 5/96	
12-ID.0.	67283	End of Be Window			
12-ID.0.	74084	End of Exptal Hutch 12 ID-D			
		Configuration after Commissioning			
12-ID.0.4	24612	Welded Bellows (% APS Front End)	APS	APS_Rspnsblty	N/A
12-ID.0.5	24812	Dfr'l Pumps, 2 @ 170 L/s, & Aperture Plates	APS	APS_Rspnsblty	N/A
12-ID.0.7		T1 ID Front-End Differential-Pump	APS	APS_Rspnsblty	N/A

Appendix C

Construction Schedule

BLine Cmpnt #	X(mm)	Description	Begin Installation	Begin Comissioning
12-ID.0.	16000	Front End for Undulator Beamline	3/96	5/96 (FOE)
12-ID.0.2	24392	Ratchet Wall: Undulator First Optics Enclosure (FOE)	5/95	5/96 (FOE)
12-ID.0.3	24542	All-Metal, UHV Gate Valve	3/96	5/96 (FOE)
		Configuration for Commissioning		
12-ID.0.4	24612	Welded Bellows (% APS Front End)	4/96	5/96 (FOE)
12-ID.0.5	24812	ID Front-End Commissioning Filter-Mask Assembly	4/96	5/96 (FOE)
12-ID.0.6	24909	APS Undulator W/B H&V Slits Fixed-Mask Assembly	4/96	5/96 (FOE)
12-ID.0.7		T1 ID Front-End Differential-Pump Support Assembly	4/96	5/96 (FOE)
12-ID.0.8	25264	ID Front-End Commissioning Be-Window Assembly	4/96	5/96 (FOE)
12-ID.0.9	25364	ID Front-End Commissioning Be-Window Assembly	4/96	5/96 (FOE)
12-ID.0.10	25464	Welded Bellows (% APS Front End)	4/96	5/96 (FOE)
	25720	**Beginning of User-Accessible Portion of Und Beamline**		
		Filters & Collimator		
12-ID.0.12		Table for F2-30s & K1A	6/96	7/96
12-ID.0.13	25720	Filters (ID Wh Light)	6/96	7/96
12-ID.0.14	25970	Welded Bellows	6/96	7/96
12-ID.0.15	26045	Filters (ID Wh Light)	6/96	7/96
12-ID.0.16	V	Pump-Out Spool, with vac gauges, valve, & fittings	6/96	7/96
12-ID.0.17	V	Ion Pump, 220 L/s, Tall	6/96	7/96
6/96	7/96	Welded Bellows	6/96	7/96
12-ID.0.19	26370	1st FOE Collimator (Und A Wh Light)	6/96	7/96
12-ID.0.20	26760	Formed Bellows, 3.5" ID, 6"x6"-195	6/96	7/96
12-ID.0.21	26955	Gate Valve	6/96	7/96
		Fixed Mask & Slits		
12-ID.0.22		Table for Fixed Mask, L5-20, & G Vlv	6/96	7/96

BLine Cmpnt #	X(mm)	Description	Begin Installation	Begin Comissioning
12-ID.0.23	27025	Fixed Mask, Config. "B"	6/96	7/96
12-ID.0.24	27165	Adapter Flange, zero-length, 6" to 8"	6/96	7/96
12-ID.0.25	27187	Slits (Undulator A Wh Light)	6/96	7/96
12-ID.0.26	V	Pump-Out Spool	6/96	7/96
12-ID.0.27	V	Ion Pump, 220 L/s, Tall	6/96	7/96
12-ID.0.28	28334	Gate Valve	6/96	7/96
12-ID.0.29	28404	Formed Bellows, 3.5" ID, 6"x6"-195	6/96	7/96
12-ID.0.30	28599	Adapter Flange, zero-length, 6" to 8"	6/96	7/96
12-ID.0.31	28621	Unshielded Transport Pipe, 6" O.D., for BMs	6/96	7/96
12-ID.0.32	C28721	Unshielded Support Stand	6/96	7/96
12-ID.0.33	C29672	Unshielded Support Stand	6/96	7/96
12-ID.0.34	29772	Formed Bellows, 5.5" ID, 8"x8"-230	6/96	7/96
		Monochromator		
12-ID.0.35		Table for BESSRC Monochromator	6/96	7/96
12-ID.0.36	30002	BESSRC Monochromator Chamber, version 1	6/96	7/96
12-ID.0.37	V	Tee for "HV" Side	6/96	7/96
12-ID.0.38	V	Ion Pump, 170 L/s, Tall	6/96	7/96
12-ID.0.39	V	Tee for "UHV" Side	6/96	7/96
12-ID.0.40	V	Ion Pump, 220 L/s, with NEG	6/96	7/96
12-ID.0.41	30815	Unshielded Adapter,	6/96	7/96
12-ID.0.42	31159	Formed Bellows, 5.5" ID, 8"x8"-230	6/96	7/96
		Be Window(temporary for FOE Comissioning)	6/96	7/96
12-ID.0.43	31389	Gate Valve	9/96	10/96
12-ID.0.44	31459	Unshielded Transport Pipe, 6" O.D., for BMs	9/96	10/96
12-ID.0.45	C31559	Unshielded Support Stand	9/96	10/96
12-ID.0.46	C32359	Unshielded Support Stand	9/96	10/96
12-ID.0.47	32459	Unshielded Transport Pipe, 6" O.D., for BMs	9/96	10/96
12-ID.0.48	C33217	Unshielded Support Stand	9/96	10/96
12-ID.0.49	33317	6-Way Cross (Possible use as B Prof. Mon.)	9/96	10/96
12-ID.0.50	33650	Formed Bellows, 5.5" ID, 8"x8"-230	9/96	10/96

BLine Cmpnt	X(mm)	Description	Begin Installation	Comissioning
		Integral Shutter		
12-ID.0.51		Table for P4-20	6/96	7/96
12-ID.0.52	33880	Integral Shutter (ID, Wh or Monochrom Light)	6/96	7/96
12-ID.0.53	V	Pump-Out Spool, with vac gauges, valve, & fittings	6/96	7/96
12-ID.0.54	V	Ion Pump, 220 L/s, Tall	6/96	7/96
12-ID.0.55	35011	Adapter Flange, 14" to 8"	9/96	10/96
12-ID.0.56		Support Shelf for 2nd FOE Collimator	9/96	10/96
12-ID.0.57	35039	2nd FOE Collimator (Und A Wh Light)	9/96	10/96
12-ID.0.58	35429	Formed Bellows, 5.5" ID, 8"x8"-230	9/96	10/96
12-ID.0.59	35659	Gate Valve	9/96	10/96
12-ID.0.60		Support Shelf for Bellows & Gate Valve	9/96	10/96
12-ID.0.61	35729	Shielded Transition Pipe, 4" I.O.D., for IDs	9/96	10/96
12-ID.0.	36057	End of FOE		
		Shld'd Beam-Xport Pipes		
12-ID.0.62	36229	Welded Bellows	9/96	10/96
12-ID.0.63	C36292	Shld'd Support Stand	9/96	10/96
12-ID.0.64	36354	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
12-ID.0.65	C38354	Shld'd Support Stand	9/96	10/96
12-ID.0.66	38354	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
12-ID.0.67	40354	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	9/96	10/96
12-ID.0.68	C40416	Shld'd Support Stand	9/96	10/96
12-ID.0.69	40479	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
		Pumping Station		
12-ID.0.70	42479	Pump-Out Spool, with vac gauges, valve, & fittings	9/96	10/96
12-ID.0.71	42639	Inline Ion Pump, 120 L/s	9/96	10/96
12-ID.0.72	C42800	Shielded Support Stand	9/96	10/96
12-ID.0.73	42960	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	9/96	10/96
12-ID.0.74	43085	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
		Shld'd Beam-Transport Pipes		
12-ID.0.75	C45085	Shld'd Support Stand	9/96	10/96
12-ID.0.76	45085	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
12-ID.0.77	47085	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	9/96	10/96
12-ID.0.78	C47148	Shld'd Support Stand	9/96	10/96
12-ID.0.79	47210	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96

BLine Cmpnt #	X(mm)	Description	Begin Installation	Begin Comissioning
		Diagnostics Cabinet		
12-ID.0.80	49022	ID Shielded Dignstcs Cabnt	9/96	10/96
12-ID.0.81		Table for L2-20	9/96	10/96
12-ID.0.82	49210	Welded Bellows, 4" ID, Shld'd Xport, 8"x8"-125	9/96	10/96
12-ID.0.83	49335	Gate Valve	9/96	10/96
12-ID.0.84	49405	Slits (Undulator Monochrom Light)	9/96	10/96
12-ID.0.85	49870	Inline Ion Pump, 120 L/s	9/96	10/96
12-ID.0.86	50191	6-Way Cross (Possible use as B Prof. Mon.)	9/96	10/96
12-ID.0.87	V	Pump-Out Spool, with vac gauges, valve, & fittings	9/96	10/96
12-ID.0.88	50524	Formed Bellows, 5.5" ID, 8"x8"-230	9/96	10/96
12-ID.0.89	50754	Shielded Transport Pipe, 4" I.O.D., for IDs	9/96	10/96
	50851	End of Diagnostics Cabinet	9/96	10/96
		12 ID-B Enclosure		
12-ID.0.90	50851	Exptal Hutch 12-ID-B	8/96	10/96
12-ID.0.91	51254	Be Window	9/96	10/96
12-ID.0.92		Support Shelf for W2-40	9/96	10/96
12-ID.0.93		Table for Gate Valve, P8-20, & 120 L/s Ion Pump	9/96	10/96
12-ID.0.94	56169	Gate Valve	9/96	10/96
12-ID.0.95	56239	Photon Shutter	9/96	10/96
12-ID.0.96	V	Pump-Out Spool, with vac gauges, valve, & fittings	9/96	10/96
12-ID.0.97	V	Ion Pump, 120 L/s	9/96	10/96
12-ID.0.98	56722	Shielded Transition Pipe, 4" I.O.D., for IDs	10/96	11/96
	56920	End of Exptal Hutch 12 ID-B	10/96	11/96
		12 ID-C Enclosure		
12-ID.0.99	56920	Exptal Hutch 12-ID-C	8/96	11/96
12-ID.0.100	57022	Be Window	10/96	11/96
12-ID.0.101		Support Shelf for W2-40	10/96	11/96
12-ID.0.102		Table for Gate Valve, P8-20, & 120 L/s Ion Pump	10/96	11/96
12-ID.0.103	66230	Gate Valve	10/96	11/96
12-ID.0.104	66300	Photon Shutter	10/96	11/96
12-ID.0.105	V	Pump-Out Spool, with vac gauges, valve, & fittings	10/96	11/96
12-ID.0.106	V	Ion Pump, 120 L/s	10/96	11/96

BLine Cmpnt #	X(mm)	Description	Begin Installation	Begin Comissioning
12-ID.0.107	66783	Shielded Transition Pipe, 4" I.O.D., for IDs	10/96	11/96
	66976	End of Exptal Hutch 12 ID-C		
		12 ID-D Enclosure		
12-ID.0.108	67039	Exptal Hutch 12-ID-D	2/96	12/96
12-ID.0.109	67133	Be Window	10/96	12/96
12-ID.0.110		Support Shelf for W2-40	10/96	12/96
12-ID.0.	67283	End of Be Window	10/96	12/96
12-ID.0.	74084	End of Exptal Hutch 12 ID-D		
		Configuration after Commissioning		
12-ID.0.4	24612	Welded Bellows (% APS Front End)	To be Determined	
12-ID.0.5	24812	Dfr'l Pumps, 2 @ 170 L/s, & Aperture Plates	To be Determined	
12-ID.0.7		T1 ID Front-End Differential-Pump	To be Determined	